

July 10, 1961

**Pilot Report
On Turbofan
Douglas DC-8**

Army-Martin Pershing

Aviation Week

and Space Technology

75 Cents

A McGraw-Hill Publication



AEROJET-GENERAL
announces the formation of
SPACE-GENERAL CORPORATION
for research,
development and production
of complete space systems

Space-General Corporation combines the experience and capabilities of Aerojet's Spacecraft Division and Space Electronics Corporation into a new corporate entity which is dedicated to maximizing national progress in the exploration and utilization of the space environment. ■ Under the leadership of Dr. James Fletcher, President, and F. W. Lehan, Executive Vice President, Space-General Corporation will apply its capabilities to conceive and produce advanced ballistic missiles; launching vehicles; military, scientific and commercial space systems; space probes; and their component sub-systems.

To further enhance its capability, Space-General Corporation is now expanding its staff of able scientists and engineers. Those capable of bringing high levels of skill and energy to this growing organization will be considered, without regard to race, creed, color or national origin. Contact MR. FERRIS SKOWEN of SPACE-GENERAL CORPORATION, 777 Flower Street, Glendale, California.

SPACE-GENERAL CORPORATION
A SUBSIDIARY OF AEROJET-GENERAL CORPORATION



**electronic and electromechanical
engineers in a unique role**

The engineers and scientists of Aerospace Corporation are in the forefront of a rapidly advancing state-of-the-art in sensing and information systems. Their unique role: a critical civilian-Vik using government and the scientific community to develop development of space systems and advanced ballistic missiles. In providing scientific and technical leadership to every element of this team, they are engaged in a broad spectrum of activities, from formulation of new concepts to technical review and supervision of hardware development by industry. Specific areas of interest include inertial and radar guidance, automatic control, communications, instrumentation, space- and ground-based computing, telemetry, tracking, auxiliary power, infrared, television, optics, and photography. New men of superior ability are needed: highly motivated engineers and scientists with demonstrated achievement, initiative, and judgment, beyond the name. Such men are urged to write Mr. George Herndon, Aerospace Corporation, Room 101, P. O. Box 99381, Los Angeles 45, California.

Organized in the public interest and dedicated to providing objective leadership in the advancement and application of space science and technology for the United States Government

AEROSPACE CORPORATION



- 
- THE *Bendix*
CORPORATION

AVIATION CALENDAR

Aug. 14—Summer Meeting on Aerospacel Applications for Hydraulic Fluids Test Methods, American Society for Testing

Advanced WPC and Space Technology

July 12, 1944

Vol. 75, No. 3

the 1980s, and the 1990s. The 1980s saw a significant increase in the number of people who were employed in the service sector, which was a result of the growth of the economy. The 1990s saw a significant increase in the number of people who were employed in the manufacturing sector, which was a result of the growth of the economy. The 2000s saw a significant increase in the number of people who were employed in the service sector, which was a result of the growth of the economy. The 2010s saw a significant increase in the number of people who were employed in the service sector, which was a result of the growth of the economy.

anywhere. But circumstances are change of a form in England, language spoken there, the fact that the British have not, in the meantime, been able to find a way to deal with the situation. The British have not, in the meantime, been able to find a way to deal with the situation. The British have not, in the meantime, been able to find a way to deal with the situation.

Postscript: Please send love to all the Additional Wags, too, please! Wags and Wags Belonging. 120 West 10th Street, New York 14, N. Y.



High range... low range-
**BOTH OF THESE NEW CEC
PRESSURE TRANSDUCERS FEATURE
BUILT-IN SHUNT COMPENSATION**

These new strain gage units are the most accurate and highly sophisticated pressure transducers ever built for rugged airborne use. They were designed to outperform every known *existing* type of instrument... and they do.

Their smart calibration feature permits the system designer to provide—quickly and simply—a complete calibration of his data handling system for precise control of associated equipment.

Type 4-228 (square) is a low-range unit for pressure ranges of 0-15 psi through 0-99 psi absolute. Standard ranges are 0-15, 20, 30, 50 and 75 psi absolute. **Type 4-229 (tubular)** is a high-range unit for pressure ranges of 0-100 psi through 0-5000 psi absolute. Standard ranges are 0-250, 150, 250, 500, 1000, 1500, 2500 and 5000 psi absolute.

Here are some of the specifications they have in common:

Rated electrical capacities: 200 ft. at 100 lbs. Rated loadings: 200 cfm minimum

causes frequency @ 20 Hz

Output impedance: 50 Ω at 200 kHz

Read subject 35,379 along listed pages

...and the ...

Concentrated temperature range,

+350 °F to +250 °F

Weight: 5.5 lb. max. includes all metal.

balance of ± 0.0006

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

For more information and complete specifications, call your

nearest CMC sales and service office or write for Bulletin CMC

4328-X2 or 4329-X3

250

Franklin D. Evans

CEC

0110

CONSOLIDATED ELECTRODYNAMICS / www.consolidated.com

CONSULTANTS: ELECTROTECHNICAL; PROJECTS LTD., CHICAGO

A copy of **Mail & Microsoft** - Free Productivity Product was sent to:

Transfer Division **CEC**

CONSOLIDATED ELECTRODYNAMICS / www.consolidated.com

A. J. KENNEDY AND M. J. HARRISON • *Journal of Interpersonal Violence* 26(10) 2011

SOLID RIVET STRENGTH WITH BLIND RIVETS

**CHERRYLOCK RIVETS for Your
Difficult Solid Rivet Applications**

BULBED CHERRYLOCK

**ONLY THE BULBED CHERRYLOCK RIVET
GIVES YOU ALL THESE ADVANTAGES**

Maximized Locked Stem • Rich Feature
No Stem Trimming • Positive Close-Up •
Full Grip Range • Complete Hole Fill • Mini-
mum Blind Side Clearance • Positive Visual
Inspection (Grip Length Marked on Head)



Meat for One Sheet and
Double-Dimple Applications—
extremely large blind head

The Bulbed Cherrylock® offers a blind rivet that installs and performs like a solid rivet. Bulbed Cherrylock Rivets will quickly show you are now using solid rivets, offering higher joint strength with greatly increased joint reliability under critical loading conditions—fatigue, shake and noise vibration.

Now Cherrylock rivets give you a blind rivet that can be used in expensive forgings as well as for joining and attaching sheets and components.

For technical data on Cherrylock Rivets, write Cherry Rivet Division, Townsend Company, Box 21028, Santa Ana, California.

* Patent Pending

CHERRY RIVET DIVISION

SANTA ANA, CALIFORNIA

Townsend Company

ESTABLISHED 1916 • BEAVER FALLS, PA.

In Canada: Remstar & Boland Manufacturing Company, Limited, Georgetown, Ontario

AVIATION CALENDAR

(Continued from page 5)

- Materials, Santa Ynez Inn, Pacific Palisades, Calif.
- Aug. 16-17-North Central States Air Transport Conference, Mason City, Iowa
- Aug. 19-20-Gordon and Noyes Conference, American Rocket Society, Stanford University, Palo Alto, Calif.
- Aug. 21-27-Gregg Engineering Conference, University of Michigan, Ann Arbor
- Aug. 16-18-International Hypersonics Conference, American Rocket Society, MIT, Cambridge, Mass.
- Aug. 19-21-Institute of the Aerospace Sciences/National Aviation Meeting, San Diego, Calif. (Continued)
- Aug. 22-24-Western Electronic Show and Conference, Cow Palace, San Francisco
- Aug. 23-25-Fourth Annual Cosmo Dynamics Symposium, American Rocket Society, Northwestern Technological Institute, Evanston, Ill.
- Aug. 24-26-Sixth Annual National Business DSI Club of America, Mid Hotel, Wichita, Kan.
- Aug. 30-Sept. 1-Third Annual Symposium for Contractors, American Institute of Aeronautics and Astronautics, El Paso, Sheraton Hotel, Los Angeles
- Sept. 4-20-1961 Living Display and Exhibit Fair, Society of British Aerial Engineers, Farnborough, England
- Sept. 4-8-Eighth Anglo-American Symposium Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, London, England
- Sept. 10-11-National Symposium on Space Electronics and Technology, Institute of Radio Engineers, University of New Mexico, Albuquerque, N. M.
- Sept. 10-12-National General National American Assn., Washington, D. C.
- Sept. 13-14-International Operations and Maintenance Symposium, Aerial Corp., Mahwah, N. J.
- Sept. 16-17-Ninth Annual Joint Societies Engineering Management Conference, in tribute of John Kennedy, Hotel Rouse, New York, N. Y.
- Sept. 18-17-Annual Convention, National Assn. of Public Aviation Officers, Miami Beach, Fla.
- Sept. 18-24-National Convention and Aerospace Symposium, Air Force Assn., Philadelphia, Pa.
- Sept. 20-21-Annual Convention, National Institute, Aerial Assn., West Hotel, Tulsa, Okla.
- Sept. 22-23-Society of Experimental Test Pilots 14th Annual Symposium (called off a format on the September Transport and Aerials, Rogers, Beverly Hills Hotel, Beverly Hills, Calif.)
- Oct. 22-23-15th International Astronautical Congress, Washington, D. C.
- Oct. 9-11-American Rocket Society's 16th Annual Meeting & Space Flight Report to the Nation, Columbia, New York, N. Y.
- Oct. 14-25-1961 General Conference, Hotel Quetzalpeten, Rio de Janeiro, Brazil
- Oct. 21-24-Joint Meeting, Canadian Astronautical Institute, Institute of the Aeronautical Sciences, Ottawa, Canada
- Oct. 23-27-7th Annual Council Meeting, International Air Transport Assn., Sydney

Another PROVEN PRODUCT FOR PROGRESS

FROM

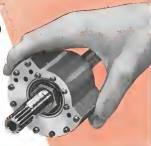


HOT GAS RADIATION RESISTANT ROTARY ACTUATOR



A real breakthrough for tomorrow's control system today. This actuator was designed for operation with hydrogen at a temperature of 500°F. in an extreme rocket-ship field.

The unique all-metal sealing system provides extremely low leakage and friction and is capable of operation at temperatures much greater than 600°F. Leakage is as low as 4 S.C.F.M. of nitrogen at 700 PSI differential pressure and 75°F. has been observed.



The Clemco Aero Products Hot Gas Rotary Actuator provides the advantages of a direct coupled rotary output with low leakage losses, and friction losses which are considerably less than obtainable with any known high temperature linear actuator with comparable leakage.

Clemco Aero Products Hot Gas Actuators can be designed for any angular travel up to 320° and in any desired capacity.

The world's leading producer of proven rotary and linear dampers and actuators in the design and metal shop of

MEMPHIS - Henry and Louis

HYPERFINE and HYPERFINE

POWER STEERING AND SHOCKS AND C

POWER STEERING SYSTEMS OF HYPERFINE AND

HYPERFINE SHOCKS FOR COMING AND

HYPERFINE SHOCKS FOR COMING AND

HYPERFINE SHOCKS FOR COMING AND

HYPERFINE SHOCKS FOR COMING AND

HYPERFINE SHOCKS FOR COMING AND

HYPERFINE SHOCKS FOR COMING AND

HYPERFINE SHOCKS FOR COMING AND

HYPERFINE SHOCKS FOR COMING AND

HYPERFINE SHOCKS FOR COMING AND

THE NEW CLEMCO CATALOG



Now, hot off the press...270 pages of proven products for progress. Designs to meet your specific application of the products listed will be supplied immediately upon request.

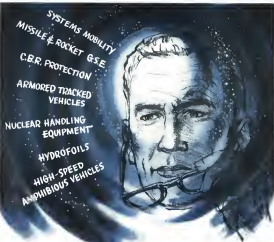
EXCLUSIVELY MANUFACTURED BY
The "Hot" and "Hotter" Hot
INTERNAL LOCKING
HYPERFINE ACTUATORS



CLEMCO AERO PRODUCTS, INC.

1525 South Main Street, Gardena, California

A subsidiary of HATHAWAY INSTRUMENTS, INC.



**ADD FMC
EXPERIENCE
AT THE
"THINK STAGE"
OF YOUR
PROJECT**

How can FMC experience help you with defense projects? In many ways. For one, FMC has more than 30 years' background in designing, engineering and manufacturing military equipment, from combat vehicles to missile GSE. Add to this our continuing program of creative research and practical engineering, exploring new areas in conventional and atomic age weapons. Applied to your project, this experience, plus our research and test data, could well save you important R&D time and money. Suggesting the earlier you call in FMC, the more we can contribute to your planning.

Want details? Write: Preliminary Design Engineering Dept., FMC Ordnance Division, P.O. Box 367, San Jose, Calif. • Phone: CYpres 4-4234.



FOOD MACHINERY AND CHEMICAL CORPORATION

Ordnance Division

715 COLLEMAN AVENUE, SAN JOSE, CALIF.

**GENERAL
ELECTRIC**
LMED
ELECTRONICS

LEADERSHIP IN AERO/SPACE ELECTRONICS



GESAC

**New flight control system
is fully self-adaptive,
performance-proven in
flight testing**

A whole new flight spectrum of manned and unmanned vehicles is at hand. To meet the unique range of control requirements of these vehicles, General Electric now offers a completely new type of flight control system called GESAC (General Electric Self-Adaptive Control).

A knowledge of the detailed aerodynamic characteristics of a missile or aircraft is not required to apply GESAC to the vehicle. Thus, both flight testing and application engineering effort can be sharply reduced.

No external air data sensors or computers are required for gain changes.

GESAC has already been successfully flight-tested aboard the Convair F-106 under Navy Bureau of Weapons sponsorship. An evaluation of extremely rigorous re-entry profiles has been conducted on the North American X-15B simulator under Air Force contract, with outstanding success. A flight evaluation on the McDonnell F4H-1 is currently in progress under Navy ReWep contract. GESAC provides another example of Light Military Electronics Department leadership in aerospace electronics.

GENERAL ELECTRIC

Light Military Electronics Department
Armstrong & General Motors, Littleton, Colo., New York



TACTICAL Combat Surveillance

Threats to America's new skills and advanced weaponry have created new requirements in combat surveillance—new needs for accurate, real-time, day-and-night and almost all high-speed intelligence gathering and transmission under fast-changing combat conditions.

Target location, damage assessment and other surveillance missions demand the most advanced techniques in guidance, data links, and data processing if they are to give the field commander the intelligence he needs in time for him to put it to tactical purpose.

Sperry is meeting difficult assignments of this nature in many defense areas now. No organization has more experience in greater depths—in guidance, control and complete systems for surveillance, drones or manned aircraft. And with the breadth of its experience in associated technologies, Sperry is ready now to meet the toughest assignments in combat surveillance—survival combat surveillance for today and the tomorrow to come.

SPERRY

SPERRY PHOENIX COMPANY, DIVISION OF SPERRY RAND CORPORATION, PHOENIX, ARIZONA

HIGH CLAMP-UP MEETS MACH 2 STRUCTURE NEEDS



Faster the speed, more varied the mission...the more critical are the structural requirements. Such is the Navy's newest all-weather, nuclear weapons carrying aircraft...the carrier-based A3J Vigilante.

Because of their excellent residual preload characteristics, Hi-Loks were selected for use throughout the A3J primary structure. The unique Hi-Lok torque-off feature produces a high, uniform clamp-up of high tensile sheet materials in all gmp conditions. The installation method is smooth and quiet. Inexpensive, lightweight, Hi-Lok tooling reduces worker fatigue and avoids the need for heavy squanders or bulky pull-type equipment and their limitations in close quarters. In open areas, Hi-Loks can be installed at speeds up to 45 per minute.

Write or contact us for Hi-Lok technical and specification data.

hi-shear

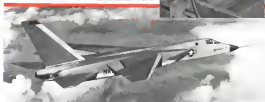
CORPORATION

2500 WEST BAYVIEW STREET • TORRANCE, CALIF. 90501

RIGHT—Hi-Loks are being installed in the A3J rear fuselage with Hi-Lok 4000 angle loading aligned in a Robert Whitney fixture. Other Hi-Lok structural loading is available in straight, in-tension and offset styles to maximize efficient, or light clearance conditions resulting from the structural demands of reinforcements at high reference interfaces such as the H/Lok.



ABOVE—In strength and temperature uses, the A3J uses stainless steel Hi-Lok pins (125,000 psi stress at 100,000 psi tensile) with studs made to 8000 lb/inch² with stainless steel collars. These Hi-Loks can be used in 100 °F. After primary structure uses alloy steel Hi-Loks (100,000 psi stress at 148,000-150,000 psi tensile) with studs made to 5000 psi at well as heat-treated to 100,000 psi stress.



A Major Mistake

The United States made a major policy mistake in abandoning high priority for advanced manned aircraft development and accepting at face value Nikita Khrushchev's statement that the Russians are pursuing the same policy to concentrate on ballistic missiles. The last serious contest during the interwarship for the 1961 Tashiro on show scheduled to be flown yesterday over Moscow. In the month long rehearsal for this show, Western observers perched on the railroad embankment that borders the grassy Tashiro field were able to identify three new supersonic bombers, two new Mach 2 plus fighters, a new jet supersonic, a flying crane helicopter and a convertiplane the size of a DC-4 transport.

They also were able to note that the Red Air Force has equipped all of its latest operational fighters, such as the MiG-21, with air-to-air missiles. The new F-4 Phantom II, with air-to-air missiles and infrared guided missiles and has rendered its big bomber fleet of Bees, Bears and Badgers with air-to-ground missiles with ranges up to 300 mi., supersonic speeds and radar guidance.

Largest of the three new supersonic bombers is the Beeser (AW Dec. 1, 1958, p. 27; July 3, p. 27), an extremely large aircraft of 8-10 mi. in its present configuration, bomber with high subsonic cruise capability with supersonic dash performance in the target area. It is built to take advanced powerplants, such as nuclear heat sources, turbojet turbofan engines. The Beeser is its conventional powered version is an extremely tactical bomber posing a grave threat to the North American air defense system. In its nuclear powered version, it would be a multi-thrust missile launcher, only warning center and ECM station.

Next down the scale comes a beautiful new design that consists two large turbojets on each side of the vertical tail fin and subsonic cruise speed. The Mach 2 bomber is larger than the Soviet B-58 and also is in the heavy class with retrothrustable range down refueling.

The third supersonic bomber, Bander, is in the medium class and appears to be a highly advanced development of Yakovlev's earlier Bander (AW Jan. 26, 1958, p. 38). It has slender rounded nose gets with a sharp wing sweep and looks as though it could edge Mach 2 in top speed.

Whether there are further surprises is still far from certain of the Tashiro show, was not yet apparent at this writing. But the appearance of these three supersonic bombers makes clear the folly of abandoning the F-105 fighter project, aimed at developing a long range Mach 3 intercepter as part of the B-70 program, and of allowing the air defense of North America to slide into obsolete status on the grounds that the Soviet missile bomber threat would never go beyond the subsonic Bees and Bears.

The Bees and Bears fleet is now a new and more powerful threat in a second way: they follow behind the supersonic bomber, having their missile nose locks onto targets from beyond the range of the Nike Hercules missile and against a thinly manned intercept force of F-106 and F-101 fighters overextended by the first supersonic wave of attacks.

Even the advanced B-70, and Canada and France have and the SAGE system have not been redesigned to handle supersonic bomber attacks. Plans to do so were scrapped several years ago by the same defense officials who killed the F-105 development, cut down the F-106 Mach 2 intercepter program and slashed the Beeser B missile force.

The two new Mach 2 plus, long-range intercepters deployed during the Tashiro rehearsal, plus the modernization of Phantom, F-4, Phantom II, Phantom and Phantom fighters with cultural and radar-guided air-to-air missiles, indicate a vastly increased air defense capability against strategic Air Command bombers. B-57 bombers and highlight the potential small number of supersonic B-70s now proposed for the SAC fleet. It also shows that the slowdown of the B-70 development program was the shortest step.

These new developments also indicate that the Soviets are not relying entirely on ground to air missiles for their air defense. These missiles represent only the outer defense line. The long-range intercepters equipped with subsonic cruise, guided missiles and Mach 2 plus speed to beat their quarry as the target enters areas on which the Soviet count for the significant striking of attacking bombers.

Both the launch of supersonic bombers and the third generation of supersonic fighters indicate that the Soviet experience with ICBM reliability must be puzzling about our own and that, despite Mr. Khrushchev's nuclear sitting, they are still depending on the manned bomber as their first line of long-range offense. It also indicates they do not rate the effectiveness of our ICBM attack capability very high and are more worried about the delivery capability of the SAC fleet.

The initial folly of continuing advanced manned aircraft development occurred as the Eisenhower administration in the face of official USAF warnings that this policy was foolhardy. But it has been enthusiastically endorsed by the Kennedy Administration in general and in particular by Robert McNamara, his Secretary of Defense.

Only in Congress where the sage counsel of Representatives Carl Albert and George Mason and Senators Russell Brydger and Jackson Proctor, did the case for the continued development of manned bombers get a fair hearing. And we doubt whether those politicians of Congress, in the midst of passing on the Fiscal 1962 defense appropriation and authorizations bills, were given much information on the enormous new risks that darkened Moscow skies in force.

We reminded that Congress and the American people demand the truth about the new Soviet supersonic threat and that they earnestly require into who made the incredible mistake of totally abandoning advanced manned aircraft development to get off of our eyes in the ICBM basket long before their weapons reached operational reliability and technical maturity—and what our leaders propose to do about it now.

—Robert Holtz

The satellite with the stop-and-start engine



The Agena 8's own engine ignites and drives it to a controlled velocity when the stage booster burns out and disintegrates.



Banks ejects from earth at its own stage Agena. Its engine is boosted against its own nose toward the target orbit.

Why the Agena 8 gives America more of bits for the money

The Agena 8's powerful rocket engine was first started and stopped in mid-air by the Agena 8's own engine. This engine is mounted 1) much greater velocity of reaching the desired orbit; 2) a heavier payload to a higher orbit from a given first stage booster; 3) increasing orbital velocity to around the target orbit which holds great promise for communications and navigation satellites; 4) maintaining a mid-orbit position on orbit for long periods. Lockheed built Agena 8s are now being used by the Discoverer, Vela, and Hubble programs of the U.S. Air Force, the Advanced program of the U.S. Army, and the Ranger, OGO, OGO, and Hubble programs of the National Aeronautics and Space Administration. Major subcontractors General Electric, Bell Aerospace, Philco.

LOCKHEED
MISSILES & SPACE DIVISION, SIMMONS, CALIFORNIA



Assembled and in oil test cell, the 100-ton rocket engine is being tested by the Texas Instruments Apparatus Division.

TI's ELECTRO-OPTICAL SYSTEMS CAPABILITY



MINSTEMAN
Minsteman, the Texas Instruments Apparatus Division's most advanced electro-optical system, is used for the development and testing of electro-optical systems. It is used for the development and testing of electro-optical systems.



WALL SYSTEM
Wall System, the Texas Instruments Apparatus Division's most advanced electro-optical system, is used for the development and testing of electro-optical systems. It is used for the development and testing of electro-optical systems.



TOLANS
Tolans, the Texas Instruments Apparatus Division's most advanced electro-optical system, is used for the development and testing of electro-optical systems. It is used for the development and testing of electro-optical systems.

Precision optics, electronics and mechanics are being combined at Texas Instruments into new high-accuracy alignment, calibration and tracking systems for advanced programs such as Minsteman, Palaris and Nike-Zeus. This capability began in 1960 when TI integrated complete optical facilities and the skills of veteran craftsmen with the company's total corporate capability which includes development of complex military electro-optic and mechanical apparatus plus basic and applied research and manufacture of ultra-pure optical materials and detectors. This unique technology has now been extended into the fields of navigation, stabilization, detection, tracking, communications and energy conversion. For information on your specific electro-optical requirements, contact MARKETING DEPARTMENT.

APPARATUS DIVISION
PLANTS IN DALLAS
AND HOUSTON, TEXAS



TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE
P.O. BOX 6015 DALLAS 22 TEXAS

WHO'S WHERE

In the Front Office

Neil M. Blum, president, Argonne Corp., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Dr. Gen. Chas. E. Ross, USA, retired, is now president of the company's operations.

Donald C. Schatz, vice president, Velsco Systems, 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Harvey F. Jaffe, vice president, United Aircraft International, East Hartford, Conn., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

Robert C. Conant, vice president, and engineering, Adams Industries, Inc., 1000 Broadway, New York, N.Y., is now in charge of the company's operations.

INDUSTRY OBSERVER

Argonne Corp., the corporation that would be first from the Argonne Corp. to meet meeting ICRM workshop (AW July 3, p. 78), are in the forefront of the development of the workshop. They are also in the forefront of the development of the workshop.

Navy and Coast Guard each will receive two Suez 7 series radioisotope nuclear power generators, one producing 5 watts and another producing 10 watts. They will be used for such purposes as buoy, automatic weather stations and navigational facilities.

Stout 5 launch vehicle is currently scheduled to carry in \$10 payload scheduled to be 5.55 megawatt-level based satellite which failed to go into orbit. The test is not a backup but is planned in a repeat to ensure successful launch. The \$10 is to be launched from Wallops Island, Va., within three weeks.

Only currently from Air Force VTOL requirement is SOAR-187, specifying a small aircraft-carrying aircraft to be carried by a C-130 class aircraft in a multi-engine aircraft. The \$10 is to be launched from Wallops Island, Va., within three weeks.

National Aeronautics and Space Administration plans to build a state-of-the-art facility at Wallops Space Light Center for the Redstone F-2300. The facility will be used for the development of the Redstone F-2300. The facility will be used for the development of the Redstone F-2300.

General Electric is trying to make time between overhaul for the C-130. The \$10 is to be launched from Wallops Island, Va., within three weeks.

At Time is to make another look at its currently canceled mobile Minuteman program in August. This information was planned before the House Appropriations Committee reported concerns over the program in the program.

West German research firm is working under Air Force contract on development of a lightweight power for aircraft that would absorb radar signals, detecting or blocking their return to the receiver antenna.

Air Force has at least two advanced sub-ICRM research support projects under way—GAS and SARD.

Proposals for the ultra-high frequency communications system which is to link the sub-orbital Titan II boosters are due at Air Force Ballistic Systems Division July 24. Ballistic probably will include Ballistic, Electronic Communications, Collins Radio, Hughes Aircraft and a team of General Dynamics Electronics and Motorola.

Auracore Corp. is getting more solid propellant manufacturing or test capability for producing rockets and costs for large rockets, as well as in their area of propellant rockets, methods of production and test facilities.

Douglas is proposing a second stage called Dina-A, using liquid hydrogen and liquid oxygen propellants for a space booster being proposed to NASA and the Air Force. First stage would be a Thor IIEM with three Thor IIEM 20,000-lb-thrust solid fuel rockets clustered around its base.

NASA is testing three fluid pressure measurement devices for possible use in future Mercury capsule flights. Fluid pressure was an important factor in measuring driving force. Mercury MB-2 flight, but the agency hopes that a similar sensor can be developed in time for the first manned orbital flight. Data probably will be recorded and stored in the capsule rather than being transmitted in flight.

ON ORDER from LIBRASCOPE



**CENTRAL DATA PROCESSOR
for AIR TRAFFIC CONTROL**

Today, at a peak traffic hour, approximately 200 aircraft flew over the New York area. Each year this number will increase. Yet, the Federal Aviation Agency will continue to assure safe and efficient control of air traffic. One reason is a data processor developed for the FAA by Librascope to quickly and accurately handle the routine clerical tasks now occupying most of the controller's time. The first 18-unit data processor will be installed at Boston in 1962. A note to Librascope outlining your control problems will bring a prompt answer from the country's most versatile manufacturer of computer control systems.



**GENERAL
PRECISION**

COMPUTER CONTROL SYSTEMS
that save man's expanding mind

LIBRASCOPE DIVISION | GENERAL PRECISION INC., GLENDALE 1, CALIFORNIA

Washington Roundup

NASA-Defense Study

Studies of the total national effort needed to provide facilities and support for the lunar landing program have been launched under an agreement between National Aeronautics and Space Administrator James Webb and Defense Secretary Robert S. McNamara. NASA now leans heavily on the military aircraft for launching and landing facilities, life support, and air and sea support and rescue forces. The agency will require even more help for the lunar effort.

An F-105 study begun by Maj. Gen. Leighton I. Davis, commander of the Air Force Missile Test Center, shortly after President Kennedy announced the lunar program, have recommended great expansion of facilities there, including additional launching platforms to eliminate noise and damage problems. One officer noted that this ambitious plan amounts to "moving the Florida peninsula three miles west from Cape Canaveral."

After the agreement was reached, Defense ordered studies made from a department-wide point of view, to include all services and their logistics systems. NASA studies are emphasizing impact on the national economy.

Rep. Earle B. Thorne, who has consistently favored use by NASA of existing military life sciences research rather than expansion of NASA's own life sciences program, said last week the agency is using the lunar program as a cloak to ask for a \$60-million manned space flight laboratory and increases of 100 people and \$12.6 million for life sciences research. He urged that the military's expenditures not be wasted.

Political Tug-of-War

Both the manned flight laboratory and NASA's Space Task Group, which is managing Mercury and probably will direct Apollo spacecraft development, are the victims of a political tug-of-war. Rep. Albert Thomas, chairman of the appropriations subcommittee that passes on NASA's budget requests, has made no secret of his desire to have both located in his Texas district. Meanwhile, Rep. Thomas N. Downing is seeking 40,000 signatures from his Virginia constituency for a bill of \$75 million from Langley Field. Despite Rep. Thomas' power, there are indications that he has lost the battle. But all NASA Administrator Webb will say is that no final plan has been approved.

Congress is growing increasingly reluctant to confer the kind of long-range authority for executive agencies that would enable efforts such as the 10-year space program. Although the lawmakers recognize that complex technological projects cannot be successfully run on a year-to-year basis, they fear loss of congressional control over government.

This dilemma, now working more slowly as well as the conservatives who have long fought what they call "blockbuster spending," slows the building for public housing on long-range federal programs which the Senate Government Operations subcommittee under Chairman Hubert H. Humphrey will hold July 18-19. Measures will include Defense Department Comptroller Charles J. Hatch and Dr. Harold Brown, director of defense research and engineering.

Hyushims for Cuba

Cuba's state-owned airline, Compañia Cubana de Aviación, may become the first commercial operator of Soviet-built aircraft in the western hemisphere. It now is negotiating to buy replacements for Douglas DC-10s—probably Douglas B-12 or B-14 transport cargo transports. Cuba also is considering a Bristol Britannia cargo aircraft that could lead to flights between Havana and Prague or Moscow on a cargo basis. Hard pressed for working capital, the airline is trying to sell three Sukhoi Su-7 fighter bombers to France, the purchaser.

Russian delegation is expected to arrive in Havana this week to begin negotiations on a U.S.-U.S.S.R. bilateral air agreement involving New York-Moscow service, including the controversial Soviet request for a route segment to Havana (AWW May 6 p. 61).

If the political situation deters Soviet Russia and Communist East Germany have a bad trade with which to try to shift U.S. air traffic away West Berlin. A law in take effect on Aug. 1 will require all aircraft with visas to receive special permission from East German authorities to cross their territory. This traffic now is handled by a few airlines on safety routes.

Russia has removed its protests over flights of the Lockheed U-2. Two Soviet officers, writing in the Russian journal Red Star, say the use of Aleksandrov U-2s to check reconnaissance satellite equipment poses the "greatest question in the U.S. cannot abandon the dangerous habit of looking through their neighbor's keyhole."

Canaveral Calamity

At the Atlantic Missile Range, where so far has been killed or seriously injured by the launching of a rocket in 11 years of operation, a 1.5-m. diameter, 12-in. long asteroid followed a crash trajectory on Feb. 4 and broke a window in the office building. Seven persons were injured, two seriously enough to require hospitalization.

—Washington Staff

NASA Review Supports Atlas Despite Space Launch Failures

Washington—Frustrated by the National Aeronautics and Space Administration's decision to delay its failures, there is nothing bouncier going with the Atlas as a space launch vehicle.

The Atlas, the key to successful manned orbital flight in Project Mercury, has been under a cloud because of failures in the space program (AW Jan 23, p. 38). In 12 space missions during Atlas launches, four have been successful, six partially successful, and seven have failed. Upper stages and components, rather than the Atlas itself, account for most of the failures where the cause has been determined.

As a result of these failures, on all-NASA ground reports, made a technical survey of the Atlas in the areas of structure, loads, materials and dynamics and concluded that the agency can choose among three alternatives to reduce use of the vehicle.

- Strengthen the entire structure during production, making the vehicle heavier.
 - Limit mission to optimum Atlas characteristics, and launch at optimum times with a standard vehicle.
 - Fly ahead for specific vehicles to launch specific payloads, conduct structural vibration loads, dynamics and "stress-baked" vehicles.
- The panel favors the last alternative.

Since the first two would involve production and mission penalties.

The implication that advance planning has been defense items from the Atlas space record. Of four Mercury flights, one was successful, two failed and one is considered a partial success. The three Atlas missions failed, and of four Agenas, two Agenas and two Minis launches only two were successful. The other success was Project Scout. There have been 51 complete successes in 41 development flights of the Atlas D as a missile system.

NASA has ordered special modifications of the Atlas D for Mercury and in considering entering them into existing operational situations. RWGI reports. The agency feels the Mercury payload and the Atlas was made compatible with the limitations of a steel crating and launch structure, upper vehicle (AW Jan 16, p. 37). The restructured design GNG will be launched by a lightweight Atlas Agena B, and a special thrusting will provide stability for the payload.

NASA is not considering changing launchers for Mercury because, as changes, new would cause a serious delay estimated at 30 months and because the agency is convinced the Atlas is able to perform the Mercury mission. Last Mercury Atlas (MAT) launch

Apr. 25 failed because of an electrical malfunction in the programmer. George M. Low, NASA assistant space flight chief, said all indications point to a "good fix" and a modified programmer has been under test for two weeks.

MAT was destroyed by the range safety officer when it failed to push over and the programmer was found based in the wind at Cape Canaveral about a month after the launch. Low said finding the programmer, together with "defective" seals by General Dynamics Astronautics, Air Force Space Systems Division and Aerospace Corp., resulted in identification of 5-10 possible causes, found to components not completely tested by Mercury development. Changes have been made in the programmer and elements in preparation for the fourth Mercury-Atlas launch, scheduled to be a complete capsule system checkout in a single orbit.

White Urges Continued U.S. Bomber Program

Washington—Vicepres. have not passed this capability, according to report Air Force Chief of Staff Gen. Thomas D. White, and the U.S. should meet, also with production and development of modern bombers.

Gen. White, who stated Jan. 1 pointed out that the Russians have been a new heavy bomber. "The Russians are evidently going ahead with it, I think we should," he said during a National Broadcasting Co. Meet the Press show.

Commenting on nuclear power for launch Gen. White observed that "there exists a 'missile' and that that is not in its application of it to go on or go back in the air."

In a related development, the Joint Congressional Atomic Energy Committee in its report on the Atomic Energy Commission and its program for deployment "the apparent lack" of technical information on the Soviet Union's Project Atlas (ANP) program available to Defense Department officials when they decided to cancel it.

The joint committee and "technical information" showed that technical progress on ANP in the last two years was "sufficiently surprising" adding new approach to the Atomic Energy Commission and construction of a full-scale nuclear engine for ground test.

A number of committee members were disappointed in the classification of the project as "secret" and "The program" concern statement from the apparent lack of information on the technical state of the work is shown in the committee launch which applied the information upon which the decision to cancel the project was based.

Air Force Reorganizes Deputy Chiefs of Staff

Washington—Office of two Air Force deputy chiefs of staff have been reorganized in cooperation with the Air Force chief of staff, General Curtis E. LeMay, Air Force Systems Command, Logistics Command and Office of Aerospace Research.

Gen. Mark E. Buehler, research deputy chief of staff, research, has since deputy chief of staff, research and logistics (AW Apr. 10, p. 35). He is assistant for logistics in Major Gen. W. J. Scott, the assistant for research in Major Gen. Joseph R. Blodgett, and the director of research operations in Major Gen. William D. Adams.

Gen. Buehler's new office combines responsibilities of development, research, logistics support of aircraft, missiles and space, and electronic warfare. It will have authority over some research, advanced technology, studies and technical and development planning. Deputy chief of staff for research and technology is Lt. Gen. Robert F. Wilson, who is deputy chief of staff of development. His assistant is Maj. Gen. Victor R. Hengen.

Director of Advanced Technology under Gen. Wilson is Maj. Gen. Albert C. Denker, director of research in Major Gen. Ralph L. Wenzel, and director of development in Major Gen. William R. Kautz.

The office is responsible for long-range plans, policy and objectives of Air Force research, and it will identify and report technical advances in the field of space in the Air Force for action.

Although the director of system operations has responsibilities for staff functions at development, production and production research, research, the Mission Management and B-70 bomber will have their own staff officers reporting directly to Gen. Wilson.

These special offices will report through the chief of staff to a proper's office.

Scout Launch Fails With S-55 Satellite

Washington—Attempt to place the four-stage S-55 intercontinental satellite into orbit failed Jan. 23 when the third stage of the four-stage Scout launch vehicle did not ignite.

The launch from Wallops Island, Va., was the fifth in a 10-day Scout first stage development program. Two ballistic tests were successful, and one of two earlier satellite launch attempts failed. Scout was used to launch the Explorer X satellite as a drug satellite into orbit.



New Soviet Mach 2-Plus Fighter

New Soviet Scout launch interceptors armed with air-to-air missiles for use in Western theaters in the eastern theater in the Taurus in the West. This delta-winged fighter appears to be a MiG-21 derivative developed from the earlier Folland (AW Dec. 27, 1959, p. 37) but considerably larger and with longer wings than the earlier Mach 2 design first exhibited in 1955. The new fighter is about 35 ft long, has a single large air intake with a conical diffuser that houses air intake interceptors. It appears to have three engine nozzles at the tail of which two are in line with the third a large rocket nozzle motor. Air to air interceptors appear to be air-to-air guided, similar to the US F-106. This new design is believed to be the Soviet's latest design, the "MiG-21" in the Soviet's world and already exceeds for a 4 of 1,350 mph and 112,000 ft. Large dimensions of the earlier Folland have been observed in the interceptors during four air-to-air missile tests during these days. These Folland also carry interceptors.

Feb. 16 in its only successful orbital launch.

The S-55 payload, which would be a high-speed fighter, was in fact a small satellite, the S-55, which was launched by the Scout launch vehicle.

- Promoted cell detector system, as reported in National Aeronautics and Space Administration's Logistics Research Center, consisting of 100 ball cell detectors, is a first in the world, the fourth stage, the cell, processed with organic world detector system.
- Promoted cell detector system, as reported in National Aeronautics and Space Administration's Logistics Research Center, consisting of 100 ball cell detectors, is a first in the world, the fourth stage, the cell, processed with organic world detector system.

• Fuel gas detectors, designed by NASA's Lewis Research Center, consisting of 50 Mallory triangles mounted under the S-55 payload.

- Mission management, the first in the world, which had four detectors, were to be recorded.
- War gas, essentially 40 copper wire, sections wound on a stainless steel core in an experiment designed by NASA's Goddard Space Flight Center. Wilson

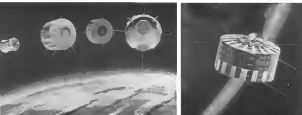
are designed to be used, when struck by an incoming missile.

- Two additional satellite cells, developed by Goddard, consisting of a "Mach 2" and a "Mach 1" to be used in the air-to-air interceptors.
- Central impact sensor, mounted on a stainless steel core, to detect impact of a missile.

Logistics Research Center integrated the payload into a sub-orbital mission, 75 in long with a 75-in diameter.

Garrison to Fly MIR-4

An Air Force Capt. Hugh L. Garrison, 31, has been selected as primary pilot in the second "Manned Orbiting Laboratory" (MIR-4) now scheduled July 15. The backup pilot will be Major L. G. John H. Gorman, Jr., who also was backup pilot for the first MIR-4. Garrison is in the Air Force's 5th, manned Orbiting Laboratory.



ARTIST'S DRAWING (from left to right) Agena target stage, Transit IV-A Agena and Ceres. What's shown on the top of Transit (right) is a subminiature SNAP generator. Photo below shows Thor-Able-Star rocket in the one which made the actual launch.



Transit, Two

By Larry Woods

Washington—Navy's Transit IV-A navigation satellite carrying its atomic auxiliary power unit, is operating one orbital and two smaller satellites launched with it are providing information on solar radiation and related phenomena despite the fact that the Agena and Ceres III piggyback accuracy satellites failed to separate from each other (AW July 5, p. 35).

The 1750-lb. Transit package was "making perfectly" a few days after launch. Navy and Air glow phenomena which would have been produced by the piggyback cannot in the 55-lb. Agena will not be possible because the sensor is covered photo cells by the 55-lb. Ceres satellite.

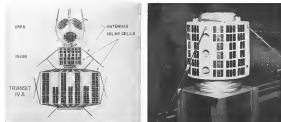
Project Moonwatch

In the first and second passes since launch, Project Moonwatch teams and Baker-Nunn camera stations reported three shorts. There should have been four—the three satellites and the fuel stage. On the next day, observers confirmed the failure of the two smaller satellites to separate.

Transit transmissions on 54 and 138 megacycles indicated that the radio-range thermoelectric generating unit and the solar cells powering two other transmitters were functioning properly.

Because the Administration had refused to allow the power unit to be placed in Transit for a launch once scheduled for June 6, but resumed its testing and permitted it to be carried in the June 25 shot (AW July 5, p. 25).

The nuclear power device remains



TRANSIT IV-A will use two piggyback satellites Agena and Ceres (left) as mounted in one shot. Ceres of Agena is shown at right. Agena is designed to be stabilized by magnetic attitude control to keep it properly oriented.

Small Satellites Work Despite Malfunction

5 in. in diameter in one direction and 55 in. long. It weighs 45 lb. and is fueled with plutonium 238. It is one of the previously demonstrated SNAP 5 unit, which was powered with plutonium 210, and it is also powered.

A comparison with conventional power sources can be made with the SNAP 1 unit, which can produce the power equivalent of 1,700 ft. of nuclear-cumulative batteries and solar cells in 240 days.

The generator is contained in a rugged capsule, prototypes of which were subjected to high impact stresses and burst tests at Lawrence Livermore. It was the safety testing program of the Atomic Energy Commission which helped bring Administration opposition to launch of space launchers for the device.

Spontaneous decay of the radioactive plutonium 238 generates heat, which, in the block surrounding it, causes thermocouples which convert it to electrical energy. This unit produces three watts of power. All such devices produce low voltage and high current.

Plutonium 238, an alpha particle emitter, has a half life of about 90 yr., making it theoretically capable of producing power for decades. However, in the Transit installation the gnd is 5 yr. of service. Cost of the generator without the fuel is \$4,500. AEC has applied the subminiature generator power to powering remote weather stations (see box p. 28).

The Transit power unit was developed by the Wright Co. for AEC and the fuel core was loaded by AEC's Mound Laboratory at Miamburg,

Ohio, which is operated by the Monsanto Chemical Laboratories.

AEC officials expect considerable time in a gross experiment, emphasizing the safety angle of SNAP-type power units, calling the capsule "virtually indestructible." AEC Chairman Glenn Seaborg said he would have no fear of sitting on the power unit's fuel element.

He compared the amount of radiation emitted by the plutonium 238 in one hour to the amount emitted during a dental X-ray. Radioisotopes must be kept under the closest observation, but in the long run the danger is small, where they can do damage to the blood-producing marrow.

Transit IV-A is a polygon of 36 sides with a flat top and bottom. It is 45 in. in diameter and 55 in. high. This is the first launch of a satellite carried in a gross experiment. Navy considers that 60 or so SNAP-type launches will be necessary before the system becomes operational.

Optional satellites will be smaller in size and will be placed in polar orbits from the Pacific Missile Range's naval facility at Pt. Arguello, Calif. Four optional satellites will initially be spaced quadrantly.

As a byproduct of the military radar system of the latest Transit (AW Feb. 27, p. 34), a new and more accurate time standard will be made available.



SNAP GENERATOR is shown to how the latest Transit satellite pilot to vibration tests.

Third Tiros Test Flight Scheduled To Cover 1961 Hurricane Season

Washington—Third weather satellite in the Tiros series is scheduled to be launched this week from the Atlantic Missile Range by a Delta vehicle, with an operating lifetime designed to coincide with the 1961 hurricane season.

Instrumentation in the T3S is packaged in a similar to that in previous Tiros satellites, with improved antenna programming for electronic equipment and newly-developed transmitter circuits in circuits which trigger the camera.

Tiros III will have two wide angle vidicon cameras covering about 750 sq. mi. of the earth's surface at a resolution of 1.5-2 mi. Narrow angle cameras used in both Tiros I and Tiros II have been eliminated, according to the National Aeronautics and Space Administration, because data from the wide angle vidicon has proven more valuable for weather studies.

The television cameras have a frame speed of 11.5 with a shutter speed of 1/5 microseconds. Video bandwidth is 62.5 kc.

Each camera can record and store on 400 ft. of video tape 32 photographs during each 98 min. orbit. The satellite is to be launched into a 400 mi. circular orbit. The package is covered by 9,500 solar cells which will provide enough to 65 nickel cadmium storage batteries.

In addition to the camera system, instruments in Tiros III are:

- **Ther radiated experiments** use a scanning device containing five actin and two ion sensors. The scanning system will map reflected solar radiation, long wave radiation from the earth and atmosphere, cloud top temperatures, and atmospheric level (25,000 ft.) temperature. Both non-scanning sensors will measure gross heat budget area continuously and the other six are transient.
 - **Barometric sensor**, also an infrared device mounted on the satellite rim which determines the satellite altitude.
 - **North indicator**, essentially a sensor of solar cells which relay data on the position of the satellite in relation to the sun.
 - **Magnetic orientation control**, a van coil around the lower portion of the satellite which generates a magnetic field to tilt the package in ground command.
- Power is gained continuously and data is stored continuously at Wallops Island, Va. (AEC News, 5, p. 25) and the Pacific Missile Range. Backup stations are at the Atlantic Missile Range and the Radio Corp. of America's Princeton, N. J., facility.

Cloud cover patterns will be photographed at ground stations and relayed tapes will be analyzed at NASA's Goddard Space Flight Center.

Antioch-Electronics, Division of RCA designed and built the vehicle and ground stations. **Borco Engineering Co.** designed two radiation detectors and the University of Wisconsin designed the third.

Ling-Temco-Vought, Inc. To Shift Subsidiaries

Dallas—Stockholders approval of the merger between Ling-Temco Electronics and Chance Vought into Ling-Temco-Vought, Inc., will be followed by separating the former's two companies' facilities and subsidiary organizations into seven new corporate groups (AW Apr. 3, p. 29).

Although officials of Ling-Temco-Vought decline to discuss specific making of the new companies, indication is that it will take this order:

- **Aerospace Systems**, consisting of Chance Vought Corp., which will be a subsidiary of LTV will contain Vought's former Aerospace and Missiles Divisions, Aeronautics Division, Range Systems Division and Marine Boat Co.
 - **Electronics Group**, which the LTV Electronics Division will consist of Temco Electronics Division, Vought Electronics, Micromodule Components Division and United Electronics.
 - **Communications and Test Systems Group** which probably will be merged with the LTV Communications and Test Systems Division will comprise Continental Electronics Manufacturing Co., Ling Electronics, the Calverne Co. and Electron Corp.
 - **Commercial and Industrial Products Group** probably will consist of Temco Industrial Division, Friedrich Refrigeration and Vought Industries, Inc.
 - **Sound Systems Group** will include Altec Lansing Corp., Altec Service Co., Perkin Electronic Products Division, Chaussey Loudspeakers, Inc. and Columbia General Corp.
 - **Automotive Group**, will have Temco Chevrolet and American.
 - **LTV Information Handling Systems Group** will comprise Information Systems a Vought subsidiary, IT&M Electronics Inc. and National Data Processing Corp., also a Vought subsidiary.
- Management of Ling-Temco-Vought, Inc., will consist of Robert McCulloch, chairman of the board and chief executive officer; James J. Ling, chairman of

the executive committee; Gerald K. Johnson, president; Clyde Stern, executive vice president; Raymond C. Blaylock, vice president technical director; Lee D. Winkler, vice president accounts and treasurer and James J. Kerley, vice president controller.

New headquarters will be established at Dallas Grand Prairie, where Chance Vought and Temco's many production facilities are located, but former Ling-Temco executives pointed out that although they are moving from their former Garland offices the program will continue building of that plant's engineering and production work, will continue in electronic environmental and other testing laboratories at Garland. Consumer products production work at the company's new headquarters, is being expanded and electronics elements work there is also expected to increase.

Former move of Ling-Temco and Chance Vought Corp. executives into new headquarters probably will not be made until Aug. 15.

AT&T, NASA Confer On Satellite Launching

Washington—American Telephone and Telegraph Co. and the National Aeronautics and Space Administration are completing negotiations for the launch of an AT&T-developed communications satellite.

The agreement, expected to be signed before the end of this month, will call for launch of a 150-lb. active repeater into a 1,000-mi. circular orbit by a Delta vehicle at an cost to the government. Launch probably will be made next year after NASA has ordered the government-developed Atlas F active communications satellite.

The AT&T project will be the first negotiated under a government order proposed by the Eisenhower Administration (AW Oct. 17, p. 26) and continued by the Kennedy Administration in order to keep commercial development integrated with the national program for a communications satellite system. However, NASA will administer the AT&T contract through its Goddard Space Flight Center.

NASA links on its Relay satellite as an experimental system, to demonstrate capability and assess component technology. AT&T feels its satellite will be an operational prototype.

Meanwhile, NASA awarded a \$450,000 contract to Douglas Aircraft Co. last week to study orbital techniques and design parameters for the Relayed rigid sphere passive satellite.

The agency plans to launch two Atlas Agena-B vehicles in 1963, each with payloads of three 135-lb. satellite spheres.



NEXT: FLIGHT-WEIGHT ROCKET FIRINGS

Current achievements by the rocket propulsion industry give mounting evidence of this nation's ability to meet the challenge in the development of large solid boosters. The next advance of major significance to the national booster program will be the firing of flight-weight segmented rockets of 250,000 and 500,000 pounds thrust at UTC's Development Center.



UNITED TECHNOLOGY CORPORATION

A subsidiary of United Aircraft Corporation

P. O. Box 546, Sunnyvale, California

Capability backed by four decades of propulsion experience



Like all our subcontract customers...
GENERAL ELECTRIC
WANTED PRECISION
PLUS
ON EACH OF THESE ITEMS

As a by-product of many years' experience with proprietary engine control systems, Chandler Evans has developed outstanding subcontract capability.

Working as closely from your drawings, CECE can produce components as available, at complete systems with equal facility—with specifications demanding production tolerances to 5 millionths of an inch and finishes to 5 RMS. All subcontract assignments are simply supported by CECE's production engineering.

Beyond this subcontracting capability are these and other "tools" of CECE's trade:

- precision equipment like Skidfield Compressors, PM's Magnapark Airbrake Profiles, Cincinnati and Sheffield Lathes, Penn-Form Crank Grinders
- tape-controlled equipment like Matheson-Matros, Pratt & Whitney Jet Bores, Bannister Turret Drilling Machines, Potter & Johnson Turret Lathes
- photographic and X-ray inspection equipment
- infra-red curing devices
- electronic and compact laboratory facilities along with a wealth of production test equipment and facilities

Mark—hydrogen gas turbine; right—jet engine test rig; top—turbine—overhauling valve

For more detailed information on CECE facilities, call our confidential salesmen or write to: General 312 or call R. M. Chandler, Chicago 9, 3051

CHANDLER EVANS CORPORATION - WEST HARTFORD 5, CONNECTICUT

E. E. Schmidt	Norman Sackin	R. L. Brown
11445 Western Blvd.	West Coast Bldg.	3801 Santa Anita Bldg.
Meriden, Conn. 06450	Meriden, Conn. 06450	Fullerton, Calif.
Telephone 7-5000	Affiliate 2-5516	Office 5-5711

Seventh Army Gets First Mohawk; STOL Aircraft Tours Europe

General First German Mohawk helicopter reconnaissance aircraft has been delivered to the U.S. Army in Europe as a prelude to scheduled deliveries to operations units this fall.

Delivery of the aircraft to the U.S. 7th Army at Sindelfingen Air Base, near Mannheim, Germany, by German Chief Test Pilot Ralph Dornel followed an extensive European tour at which the Mohawk's STOL capabilities were demonstrated to American personnel and to European military officials. Aside from its planned missions with U.S. units, Germans hope the Mohawk may be adopted by one or more West European nations in line with its recent loaned position agreement with France's Louis Bréguet (AW May 19, p. 24).

The agreement, however, is based enough in scope so that Germany could offer licensed production to firms of other European nations if orders from their respective countries lagged upon such an agreement. Breguet's recent agreement with Germany giving the latter production rights to the Atlantic helicopter and amphibious aircraft if it should be ordered in quantity by the U.S. Navy is equally broad since the American government would have the final say as to when the American manufacturer would be.

German demonstration aircraft flown to Europe recently to show its capabilities at the recent Pan Air Show attracted big defense officials from a number of countries, against a total of 29 on file, including Le Bourget, in celebration before delivery to the 7th Army.

Aside from its reconnaissance capability, German army interest centered around the Mohawk's capability as a weapons carrier in role direct it under current Defense Department intentions as U.S. Army units and resources. When being piloted by the Maroon, however, the aircraft was fitted to carry six external weapons stores three under each wing, weighing a total of 4,740 lb. Aside from photographic reconnaissance, the Mohawk also can be used for reduced detection missions and, through the installation of an electronic beam scanner beneath the fuselage, for radio reporting the use of side-looking radar.

In the event of new European production, the Mohawk is undergoing substitution of the present two 1,085-shp Lycoming T53 engines with two de Havilland Genies of 1,170-shp each assigned to helicopter configuration. The company also is negotiating to pro-

vide customers the 1,195-shp -7 version of the T53 scheduled to become available sometime next year. The T53-7 engines would boost maximum speed of the aircraft from just under 150 mph to slightly above 160 mph.

During its European tour, the Mohawk operated from one airfield located within four and one-half miles of the East German border, according to German officials, and in two other locations, four hours within an area of the border. The standard performance included a low-altitude, high-speed pass with a turn and roll into the dead engine.

Proposals Submitted For Lift-Fan Vehicle

New York—U.S. Army is expected to soon announce its choice of an American manufacturer to develop a test vehicle for General Electric Co. lift fan concept.

Dr. Laurence Krieger, Bell, Gossard, North American, Northrup Aircraft and Sikorsky have submitted proposals. Observers understand that notwithstanding it will be one factor nothing in the final choice.

Specifications call for a maximum speed of 415 kt and a maximum dead weight rate of 1.2. Fuel is to provide for 20 min of vertical flight capability, plus out in the specific case of a lift fan concept, capabilities under IFR rules, is suggested.

Performance levels of the fan required to meet specifications have been demonstrated by General Electric as a test program. Flight vehicle will be used in vertical speed is given in both VTOL and STOL modes.

News Digest

British European Airways is considering the purchase of three Boeing Vertol 107 helicopters for cross-country service connecting London with Sydney, but in British Vertol's world be in the helicopter parking a Rotolux production design.

Australian government has ordered 77 Westland Wessex AS560 helicopters for the Royal Australian Navy, in a \$14 million order, after evaluating the Wessex against the Bell Hopwood and Kaman K-100.

Rathson has a \$13,577,941 fixed bid contract for 40 night solar display systems, the first of which is scheduled for delivery next spring. The new equipment to be installed in FAA's Air Route Traffic Control Centers, also can be converted to provide a solar picture of area traffic that controllers can see in a normally lighted room. Ten FAA centers and four airport control towers now are partially equipped with night display systems.

Civil Aeronautics Board has stayed its order granting a blanket exemption to Saturn Airlines to operate trans-Atlantic passenger flights without prior Board approval while it considers petitions of Pan American World Airways and Trans World Airlines.

Boeing Co. has received a \$166,000 National Aeronautics and Space Administration contract to study design problems of large solid rocket launch vehicles (AW June 26, p. 26). NASA will use the information in writing specifications for the solid Naves, to be developed by the Air Force to meet NASA requirements.

Military Air Transport Service has awarded its Fixed 1962 contracts for Luger and Quadriplex commercial aircraft to conform with maximum rates granted by Civil Aeronautics Board (AW June 13, p. 37). However, MATA reports that it will offer CAB rates for the new six-hour service but continued the dollar volume of the Fixed 1962 contracts will be decreased pending a response for more money.

Boeing has a three-stage solid rocket containing a sodium fuel pre-burner to a test vehicle and a vacuum-optimized engine designed to meet an advanced action in the upper atmosphere. U.S. and Italy have conducted similar experiments using Nike-Ap and Nike-Cajon rockets.

Civil Aeronautics Board recommendations were sent into effect July 1 after the Senate reversed Government Operations Committee action and approved it (AW, July 3, p. 36).

Allegiance Airlines and National Car Rental System have agreed an agreement under which the carrier will require a 10% interest in National. National, which concentrates its activities in the west and north, will expand its operations to include areas served by Allegiance. National carries 500 U.S. jets and operates 12,000 cars.

Independents' Route Applications May Affect Trident Jet Orders

London-British Overseas Airways, the state-owned airline, last week said that 15 of its 34 de Havilland Trident jet transports now in order would become surplus if parallel routes were granted to the independent airlines.

Forming a general objection to 72 route applications from the Air Transport Licensing Board, BEA also warned that granting the routes would have severe repercussions in bilateral negotiations "in view of increasing protectionist and restrictive policies of European governments."

Speakers told the board that the Trident order was based on traffic projections for 1966 and that decreases of traffic from BEA to the independents would make most of the airplanes redundant.

Reference to the aircraft orders, although expected, gave a problem for the Licensing Board. Besides British Overseas Airways, the largest manufacturer, 10 BEA's 111 Tribs have been built (AWM Jan. 15, p. 47). These aircraft probably are contingent on British Unidair obtaining a majority of its route applications.

In testimony before the board, Peter W. Brooks, BEA fleet planning manager, said that even if all Tridents were retained in the program, a large number of other airplanes would have

to be disposed of if a cost disadvantage in defense of BEA's parking strategy was upheld. The independent airlines (AWM June 25 p. 43), W. R. Call longitudinal manager of commercial agreements claimed that these jets provided more traffic than would be normally allowed under bilateral agreements. The jets, he stressed, are reimagined every summer and winter and result in a better spread of service lanes and less displacement.

The demand that parallel routes be granted, adding that "no airline can rely on such agreement to retain its competitive position." He predicted that if such agreements were created, there would be higher loss.

In another development involving independent airlines, the British Parliament passed the North Atlantic Shipping Bill allowing Canadian Shipways Ltd., owner of Coastal Eagle Airways, a 525-seat airline, also, to be built.

• See *Canair* series later.

The bill was attacked by the Labor government as in effect a subsidy to allow Coastal Eagle to have two U.S. jets flying 707's to compete with state-owned BOAC.

FAA Assumes Control Over Tall Structures

Washington—Federal Aviation Agency, will assume licensing control over tall structures that present potential flight hazards in the U.S., department officials said. Federal Communications Commission.

FAA's new regulation, effective July 15, will require persons interested in creating certain structures to give the agency at least 90 days' notice. In general, structures must be 100 ft high, that either extend into an airport's approach plane or are within 500 ft of an airway field in this category (AWM June 28, p. 40).

The new Part 65 of the Civil Air Regulations also contains an subsection that states which will enable boards to determine whether a person or structure might pose hazards to an operation. For example, structures with a height of 500 ft, or structures with a height of 200 ft, but near a control zone or within 5 mi of a high-altitude airport, continue are considered potential hazards.

First proposed Sept. 16, the rule drew criticism from FCC, which also noted that radio and television antennas should not be the subject of FAA control.

But the rule as adopted will effectively require builders of broadcast towers to obtain permits from both FCC and FAA. At the same time, the new Part 65 provides for "interim fence areas" where broadcast towers can be constructed to maintain their maximum safe navigable airspace.

Peruvian Line Charges Violation by Panagra

Washington—Aerolineas Peruanas, Peruvian private-owned airline, has charged Panagra with violating the bilateral agreement between the U.S. and Peru and based the Civil Aeronautics Board to investigate.

The airline told the CAB last week that Panagra has been offering service to "great extent" of the traffic meeting between the U.S. and Peru, and that Panagra's operations are largely geared to serve 1000 Tribs and that the carrier is violating terms of the bilateral which require it to provide service that has in its "primary objective" the service of Third and Fourth Freedom traffic.

Aerolineas Peruanas added that while the U.S. Free air market is problems with no U.S. citizens, U.S. carriers have entered the back of the market. Panagra operates from its offices for several years in Peru into the U.S. through interchange agreements with several U.S. carriers.

The Peruvian carrier asked CAB to institute a proceeding which would enforce the terms of the bilateral agreement with respect to Panagra's excessive capacity, mainly Panagra's certificate to permit future volume or to suspend its certificate for non-compliance.

BOAC Is X-Raying Britannia Tail Units

London-British Overseas Airways Corp. is X-raying tail units of its 11 Bristol Britannia transport transports, after discovery of cracked elevator hinge brackets on a BOAC Britannia and on other owned by TIAL, the French airline.

Tests are being made at London Airport, in conjunction with a Bristol Aircraft Trust, as the airlines learn from scheduled annual inspection. The 18 airplanes had been inspected last week one fault was found. There were no cracks on three other El Al Britannias. One was first noted on a BOAC Britannia during routine maintenance.

Fairchild Plans to Build Advanced F-27s

By David H. Hoffmann

Hagerstown, Md.—Fairchild Stratocraft has designed a new advanced version of the F-27 twin turboprop transport in an effort to attract a second order of commercial orders—and its first military customers—by stretching the aircraft's range and boosting its maximum gross weight.

Despite the absence of any sales in 1960, a hard proposal of the F-27's potential market has resulted in a Fairchild decision to build eight new aircraft without waiting for new orders.

Regardless of whether new orders are received, the first advanced F-27 is scheduled to roll off the line here in September. The next three will follow at the rate of one per month beginning in October, with the last being delivered during the first half of 1962 if the company carries out its present plans.

Anticipating a Defense Department preference for U.S. airlines, Fairchild is considering the General Electric T58-GE-5, partly developed with Northrup, and the Lycoming T55-L-5 turboprops as substitute powerplants on later series F-27s. "Neither engine has Federal Aviation Agency certification, however, and I would think that airlines we should provide, increased application," Hollister, Fairchild's chief engineer, says.

These follow on variants of the Fairchild F-27s previously announced in Holland (AWM Jan. 5, p. 40) and designed independently and will have no immediate influence on Fairchild's planning. Still, a market development for the F-27, stretched aircraft, or high capacity is the reason of the stretched, however, Fairchild says that it will study the sales potential of similar aircraft in the U.S., then take advantage of military engineering projects.

In a series of tests scheduled throughout 1962, these follow on variants of the F-27, all of which are to retain the transport's basic geometry, are to be made available.

F-27C, which features a 42,000 lb gross weight aircraft—F-27s are in use on take off at 35,000 lb. The F-27C will be offered with a choice of four fuel capacities: 1,334, 1,706, 1,920 or 2,099 usable gallons. It will incorporate a large forward cargo door for maintenance troop and freight loading.

• Longer range F-27C executive turboprop. In March, 1962, Fairchild plans to submit FAA a modification of a 42,000-lb gross weight F-27C with a tail streamlining change. Continuation of a 36,000-lb F-27C with a 37,500 lb loading weight now in order now with completion scheduled for October.

Except for landing roll checks, all test flights for the 35,000 lb certification aircraft, 33,000 lb. As a result, brief tests will be needed by its test FAA approval of the heavier F-27.

All growth versions of the transport, including the right aircraft being built on specification, will incorporate Pratt & Whitney F-27C turboprop engines which center on a new and streamlining of the engine nacelle. Power will be replaced by the transport's two externally mounted wings with a single fuel tank port on the leading edge

of the vertical stabilizer. Fairchild estimates that it can increase F-27 output by about 15%.

A second major improvement planned for the F-27 is a pressurization system designed to keep the air cabin at 8,000 ft while the aircraft is cruising at 25,000 ft. To accomplish this, Fairchild increased cabin pressure differential from 4.15 to 3.4 psi on the basis of tests conducted at the Fokker plant in Holland involving pressure differentials as high as 11.5 psi to maintain a cabin pressure equivalent to 8,000 ft, current



AERODYNAMIC CLEAN-UP program for the Fairchild F-27 is designed to increase the maximum aircraft's speed by about 15%. Advanced version of the F-27C and F-27C now aircraft still have a single air intake on the leading edge of the vertical stabilizer (1) and doors on either side of the fuselage (2). Other modifications include the removal of external fuel tanks (3, 4) and 5) which are eliminated in the new configuration. Some external liquid drains also are eliminated.

F-27F Payload Range Capabilities

	Mod/1000	Mod/1000	Mod/1000
Takeoff weight (lb.)	28,000	28,000	42,000*
Landing weight (lb.)	27,500	27,500	37,500
Zero fuel weight (lb.)	24,000	24,000	34,000
Operating weight (lb.) with 50 passengers seats	34,851	34,851	35,111
Maximum payload (lb.)	10,449	10,449	10,889
Range for maximum payload (nautical miles)	800	370	780
Range for 5,000-lb payload (nautical miles)	845	8,890	1,440
Payload (lb.) (passengers)			
for 1,000-nautical range	6,000 (24)	3,220 (13)	2,520 (10)
for 1,500-nautical range	5,000 (20)	2,450 (10)	2,000 (8)
for 2,000-nautical range	4,000 (16)	2,000 (8)	1,600 (7)
for 2,500-nautical range	3,000 (12)	1,500 (6)	1,200 (5)
for 3,000-nautical range	2,000 (8)	1,000 (4)	800 (3)
Due to increase in Mod/1000 with load factor	2,000 (8)	1,000 (4)	800 (3)

* Incorporates fuel planning system.



Drainage good of AeroShell Oil W cylinder. Better than usual (left) run for 250 hours using a good straight mineral oil. Bad (right) run with later in many hours on AeroShell Oil W. Note remarkable cleanliness.

BULLETIN:

Shell answers the ten questions you might ask about AeroShell Oil W—world's first non-ash dispersant aircraft oil

Less oil consumption. Longer intervals between engine overhauls. Easier starting, faster warm-up, reduced wear on pistons, rings, cylinder bores, con lobes, lifter faces, gears and bushings. All these benefits have been obtained with new AeroShell® Oil W. Here, in handy question-answer form, are the facts.

1. What types of aircraft can use AeroShell Oil W? *Most engine types of any size. Helicopters, too.*
2. Why is it called a non-ash dispersant oil? *Because it combines special additives that help keep tiny, ingested particles on the oil from clumping together and forming deposits. These particles remain suspended and dispersed until they burn.*
3. How does this effect engine performance? *It means that ingested particles stay clean. That lubrication doesn't get all the oil they need. Your engine runs more efficiently, parts last longer.*
4. What about oil consumption? *Because AeroShell Oil W remains dispersed under wear and a thinner engine oil can expect less oil consumption.*
5. Can AeroShell Oil W reduce my maintenance costs? *If you have been*

using a straight mineral oil, AeroShell Oil W can reduce your maintenance costs substantially. Reason: your engine runs cleaner and cooler. Oil consumption is less. Thus, you can extend intervals between engine overhauls.

6. How does this new oil respond from a cold start? *AeroShell Oil W has an unusually high viscosity index. This guards against excessive thickening of the oil when cold, yet provides outstanding lubrication when hot. Result: easier starting, faster warm-up.*

7. Is AeroShell Oil W thoroughly proved? *Thoroughly. It's had millions of engine hours of flight time.*
8. Where is it available? *At Shell Aviation Distributors everywhere. Any dealer will stock AeroShell Oil W if you ask for it.*
9. Can I add AeroShell Oil W to an

engine? *Yes. It is compatible with all piston engine oils now being used.*

10. Is there more than one viscosity grade? *What do I ask for? AeroShell Oil W is available in three viscosity grades: 80 grade for small engines where straight mineral oil grade 55, 45, or 30 is usually recommended. Also is 100 and 120 grades for large engines where straight mineral oil grade 100 or 120 is usually recommended.*

FREE technical bulletin on AeroShell Oil W at your request. Write: AeroShell Oil Co., 50 West 50th St., New York 20, N. Y.



A BULLETIN FROM SHELL
—where 1,907 scientists are working to provide better products for industry

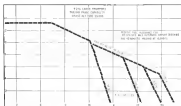


CHART shows peak cruise range capability of various versions of the Fairchild F-27. The graph shows that the F-27D, with 100 seats, has the highest range, peaking at 1000 miles at 10,000 feet altitude. The F-27A, with 100 seats, has the lowest range, peaking at 800 miles at 10,000 feet altitude. The F-27B and F-27C lines are intermediate, peaking at approximately 900 miles at 10,000 feet altitude.

F-27s currently cannot fly above 28,000 ft.

Evolution of the F-27 from its present maximum gross of 35,000 lb to 62,000 lb will add only about 170 lb to the aircraft's empty weight, according to Fairchild. As a result, almost all of the weight increase can be translated into extra fuel or, in many cases, extra payload. Fairchild also plans to market a conversion kit that will enable current operators of the F-27 to achieve the 38,000-lb takeoff weight, the 57,000-lb landing weight and the improved performance without retreating their seats to the kitchen bins.

Fairchild would admit that its F-27 sales program was in a state of relative stagnation for more than a year. From Dec. 12, 1959, until the first of 1961, only a single transport was sold, and the manufacturer has not yet placed a military order despite the fact that the F-27 was designed primarily as a Douglas DC-3 replacement. During all of 1960, Fairchild had five F-27s plus a development in its baggage rack for almost immediate delivery but there were no customers.

After the engine revolutionized the market for F-27s and renewed its emphasis on sales, late last year, however, three aircraft moved quickly. After all, an order sold at the rate of one per month began in January.

Fairchild was forced to buy back an F-27 from the Marine Corp in order to turn out certification ratings and design improvements. According to Fairchild, those 1961 sales brought in the highest rate of return of any F-27 sales to date. Largely because

performing aircraft will incorporate parts from the company inventory, the basic price of the airplane will remain at \$570,000 during the year. New LAW June 19, p. 22 and June 22, p. 531 and National Guard interest in a DC-3 replacement, no interest that could involve 200,000 aircraft, has led Fairchild to stress the F-27's merit as a utility transport or utility carrying both cargo and up to 50 troops in bucket seats or 40 passengers in truck-mounted seats. In a specially prepared brochure issued at selling the aircraft to the National Guard, Fairchild claims that the F-27 is "designed to be the Guard's next."

Alouha Refuses to Use Honolulu Terminal

Honolulu—Alouha Airlines is refusing to move into Honolulu's new \$740,000 inter-island Air Terminal unless the Hawaiian Territorial Commission makes a \$450,000 advance to reimburse the airline.

Alouha Airlines, Alouha's competitor for inter-island traffic, was the only airline competing for the new terminal when it was formally dedicated last month.

Meanwhile, Alouha appears unwilling to use the old International Airport across the field from the new takeoff terminal—without the advantage of being closer to island connections.

Alouha, which specified its section of the new terminal when the carrier was denying a transfer share of the inter-island traffic, has space about half the

size of Hawaiian's in the new airfield building.

Before the 50th anniversary can be held, the Hawaiian Territorial Council must vote whether money from a \$5.4 million 1959 Hawaiian aviation bond issue can be used for expansion of Alouha's facilities before all objections of the bond issue have been met.

The bondholders' representatives say it cannot.

The Hawaiian Territorial Commission says that unless the attorney general approves the \$40,000 construction, the money will have to be used elsewhere.

Rotodyne Helicopters Planned for Caribbean

Indes Air Inc., a new organization which has filed for status in Puerto Rico and the Virgin Islands, has agreed a letter of intent with Rotodyne VTOLs to buy the Rotodyne VTOLs. Kansas is the U.S. licensee for the 10-60 passenger compound helicopters, under development by Westland Aircraft Ltd., of England.

Deliveries target a 1965. The aircraft would be used for inter-Puerto Rico routes and routes to the Virgin Islands from Puerto Rico. The initial plans call for service to the U.S. Virgin Islands of St. Thomas and St. John as well as the inter-Puerto Rico service.

Coach Fare Increase Suspended by Board

Washington—Coast Airlines Board has suspended Board Airways' plan to increase its fares from July 1 to 7.75 to 8.5% of the London fare, an increase designed to encourage diversion of passengers from first-class to coach travel.

The suspension took Sept. 25 and gave the Board a chance to investigate the proposal, which was scheduled to go into effect between certain cities July 1. Board Airlines had the fare increase after deciding that present coach fares are causing diversion from its first-class traffic.

The carrier said that the present value of service received for a coach fare is too small to first-class value, to not use the current 35% differential from first-class fare. Board Airlines said that the main difference between first-class and coach service is the rate and speed of seating and the cleanliness of coach.

The Board noted, however, that this seating differential is "the primary differentiator" in coach fare. Board Airlines said that the main difference between first-class and coach service is the rate and speed of seating and the cleanliness of coach.

ROME, NEW YORK or ROME, ITALY...

It makes no difference to the Pratt & Whitney Aircraft powered JetStar.

The world's fastest corporate plane has intercontinental capabilities like a big jet yet it can operate from runways of less than 5,000 feet. With jetliner speed, comfort and reliability, the Lockheed JetStar can fly you direct to hundreds of smaller airports in this country and abroad. And YOU decide when to go as well as where. Four Pratt & Whitney Aircraft JT12 turbojet engines power the JetStar. Each develops 3,000 pounds thrust weighs only 436 pounds. This high thrust-to-weight ratio contributes to the JetStar's short field take-off, its swift climb, and a cruise speed of 500 to 550 miles per hour at up to 45,000 feet. The JT12's simple, rugged design ensures high reliability and ease of maintenance. And it is backed by Pratt & Whitney Aircraft's world-wide SERVICE. **PRATT & WHITNEY AIRCRAFT** is a division of United Aircraft Corporation.



UNITED AIRCRAFT CORPORATION



Kennedy Airport Bill Nears Critical Test

By George C. Wilson

Washington—Kennedy Administration support and bill, sponsored by the House aviation subcommittee to meet "backdoor spending" objections is nearing a critical test in Congress. At stake is whether for the Federal Aviation Agency to launch a long-range program to expand and improve the national airport system. The Kennedy Administration bill would authorize \$344 million over the next five years in matching funds for airports.

Fiscal conservatives in the House, afraid mobilizing for their first fight against the President's bill in reference to a five-year foreign aid program, do not like the language approach in the airport measure. They see it as an attempt to bypass the congressional appropriation process. They also fear that approving the airport bill will weaken their fight against the same type of language approach to foreign aid.

Their main objection—especially strong conservatives in the House Appropriations Committee—is the contract authority in the Kennedy Administration airport bill. This obligates the government to give a commitment, the funds needed over a contract for airport money is spent. If the congressional appropriations committee is forced to appropriate the money, the FAA, under the contract authority, could get the funds directly from the Treasury—the so-called "backdoor" approach.

Melby Urges Approval

FAA Administrator Noyes E. Hall, after urging Congress to approve the contract authority, said legislation which providing funds over a period of years is absolutely essential if we are to achieve a safe and adequate national system of airports.

He cited figures showing that construction spent much more on airports than the federal aid program was in a long-range, rather than a yearly appropriation basis. Local authorities "fear that there be some bias as to which is passed within their own jurisdictions to develop the public understanding and support for spending money on airports," Hall said.

But Chairman John Bell Williams (D-Min.) of the House Transportation Committee, Subcommittee, contending that long-range contract authority might be more efficient, contends that Congress is responsible for handling the nation's money.

"Undoubtedly," he told Melby dur-

ing the hearing as the Administration's airport bill "it would promote the efficiency of this program if Congress just surrendered all of the appropriate responsibilities to the executive branch. But that is not the way. The Constitution is another. I feel very strongly that this backdoor approach should be stopped in all of these programs."

Rep. William L. Springer of Illinois, a leading Republican on the House aviation subcommittee and an American Way supporter, agrees with this view despite all the testimony supporting long-range contract authority. The backdoor spending route was the principal reason the Administration's airport bill was delayed from May 19 when the hearing ended until June 28 when a decidedly second movement was sent to the Senate. House Interstate and Foreign Commerce Committee.

Rep. Williams described the revised bill as a masterpiece. It follows the FAA to spend whatever is appropriated in the five fiscal years from 1962 to 1966. But the House Appropriations Committee could be circumvented under this version. If it did not appropriate money for airports, the FAA could not go to the Treasury for funds. Chairman Albert Thomas (D-Tex.) of the House Appropriations Committee, which is now the airport appropriations committee, is coloring support for this.

Short-Range Competition

New York—Prospective conflict for short-range airports, now estimated at several hundred, has started off a flurry of studies and engine studies in the United States aimed at beating out the British Aircraft Corp's BAC 111 (AWM 15, p. 42).

Major opposition is to get a short-range, medium-capacity transport that can make money for the operator over 200 mi. stage lengths, and that would have in operating cost of about one dollar per passenger mile.

At least five airborne manufacturers are developing designs in the 60,000 to 80,000 lb. weight class to meet these requirements. Boeing's proposal is called the 757. Douglas has designed the two-engine 1000 and 1200-lb. weight class. The TUSA, Lockheed and Cessna are also known to have designs being worked on the requirement.

Presumably, most probable would be a jet of high bypass ratio to have cost at approximately 12,000 lb. take-off stage thrust. "Paper" engines have been developed this around this requirement.

expensive remains by allowing to appropriate enough a year in fiscal 1962 to last two on three years. But by accepting such conditions President Kennedy, near the risk of weakening the argument for the language authority to be first in construction and program. So the President is expected to exert heavy pressure to keep his airport bill intact.

The House subcommittee's report bill is scheduled to go to the Interstate and Foreign Commerce Committee this week. That will provide a crucial test of the President's strength on the backdoor spending issue. Another crucial test for the airport bill will come soon on the House floor itself.

Majority Supports Kennedy

Chairman A. S. Mike Mansfield (D-Mont.) of the Senate aviation subcommittee takes an even view. "While the bill represents the House aviation subcommittee's proposal, a 'heavy blow' to hopes for a long-range airport program."

He originally planned to wait for the House to pass the airport bill, hoping the Senate could accept the measure and avoid a conference on differences. But Sen. Mansfield and his staff will prepare the Administration's version for consideration by the Senate Committee on Commerce, which is now the Kennedy Administration airport bill pass the Senate each.

The threat to the airport bill from the backdoor spending argument continues sharp, with the House, its leaders and after President Kennedy's election. This bill that with the threat of former President Eisenhower's veto threat, a long-range bill would pass through Congress each.

President Eisenhower vetoed an airport bill in 1954 providing \$180 million a year for five years. In his Jan. 19, 1959, budget message, he called for long-range hopes for presidential support of a similar airport bill is calling for an under \$1 billion a year for the program by 1965. As a result of this attitude, the Senate that year vetoed the Democratic bill calling for a five-year, \$575-million program in a four-year plan for \$465 million. The House then the program from \$1.2 billion to \$297 million. The Senate and House failed, agreed for a simple two-year extension of the then existing airport program at \$65 million annually.

The Kennedy Administration bill represents a revival of the Democratic recommendation made while President Eisenhower was in the White House. But there are several new features in changing \$7 million a year for general

find the storm's soft spot



COLLINS WEATHER RADAR presents a complete picture of the weather ahead, showing the smoothest route through or around storms. Not restricted by "tunnel vision," it scans a broad 120° sector of the sky (360° with 30° antenna), with ranges up to 150 miles ahead.

The WP-103 X-band Radar weighs only 48½ pounds—the result of a new design with extensive transistorization. It features a 12", 18" or 30" stabilized antenna providing a clearly defined picture on the indicator, regardless of aircraft pitch and roll, for hoodless, daylight viewing, a bright tube indicator is available. Write for a detailed brochure.

COLLINS RADIO COMPANY • 6000 N. HIGHWAY 101 • SUITE 101 • GALLUP, TEXAS • HAWTHORNE BEACH, CALIFORNIA

COLLINS



action airports not used by the scheduled airlines. The argument for this type of Federal aid is that the expansion of general aviation airports will relieve congestion at the major fields now handling mixed traffic.

Another innovation in the Administration bill is authority for FAA to deny Federal money for an airport which does not have landing aids "required for the safe and efficient use by aircraft of the airport." This specific power would strengthen FAA's hand in dealing with airport officials.

There are the major fiscal provisions in the Kennedy Administration airport bill.

• States would receive \$49,875,000 a year for fiscal 1962 through 1966 under the population-based formula in the present Federal Airport Act. The annual amounts would range from \$5,094,944 for Alaska to \$78,131 for Delaware. At the end of a fiscal year a state that did not sign a contract with the federal government for its share of the airport money, the amount not obligated would go into a special fund held by the FAA administrator. They have two years under the present legislation.

• Discretionary fund would total \$16,625,000—15% of the \$77-million annual input-in risk of the five fiscal years.

• FAA could assign \$7 million a year for building and improving airports. "The primary purpose of which is to serve general aviation and to relieve congestion at airports having high density of traffic serving other segments of aviation." These funds would not have a deadline for use.

• Puerto Rico would receive \$975,000 a year, and \$575,000 a year would go to the Virgin Islands.

The states would have to match the federal contribution dollar-for-dollar as their general appropriations as set in law. But they would have to provide only 25% of the funds for landing aids, such as approach lights and aids to navigation systems. No federal money would go for airport parking lots or facilities such as control towers.

The current airport act, authorizing \$65 million a year, expired July 1. President Kennedy, in asking Congress for new legislation, is asking Congress to fund the program of federal aid over to airports is essential to us as a small country, passenger safety and economic growth." The Airport Department, General, American Association of Airport Executives and National Association of State Airport Officials and their joint views of airport needs conflictual last fall disclosed that in the first year, from July 1, 1961, to June 30, 1962 the 16 states need \$512.5 million more for airports than they can raise. (See last.)

State Airport Financing Needs

July 1, 1961 to June 30, 1965

State	Publicly Owned Airports	Altogether Reported Projects Planned	Cost of Projects Planned	Funds Available and Anticipated from Local and State Sources	Additional Funds Needed
Alabama	10	8	\$4,340,000	\$1,181,150	\$3,458,850
Alaska	219	118	27,280,200	11,754,720	15,415,520
Arizona	101	23	24,892,833	14,574,519	10,318,314
Arkansas	25	16	5,318,400	723,200	5,591,200
California	312	44	125,727,771	77,264,452	48,463,319
Colorado	26	8	16,939,723	11,820,327	5,119,396
Connecticut	7	12	13,345,600	9,770,730	3,574,870
Delaware	1	1	750,400	108,000	642,400
Florida	83	20	30,412,844	38,740,417	26,222,202
Georgia	41	7	49,340,600	21,734,650	27,605,950
Hawaii	11	8	23,187,200	13,496,450	10,690,750
Idaho	105	10	2,558,799	1,412,412	1,146,387
Illinois	24	20	47,341,600	30,371,300	16,970,300
Indiana	100	17	4,487,500	4,454,111	4,113,689
Iowa	31	23	13,147,897	4,009,177	9,138,720
Kansas	99	18	5,446,500	1,197,250	4,249,250
Kentucky	21	20	20,318,713	16,400,373	12,719,340
Louisiana	41	16	36,371,400	14,149,360	14,612,700
Maine	29	17	3,345,210	2,121,254	2,223,956
Maryland	31	8	17,340,100	10,426,121	6,914,979
Massachusetts	24	40	26,324,400	21,283,950	14,740,440
Michigan	115	10	46,497,144	31,355,144	36,772,770
Minnesota	183	21	16,472,212	9,126,291	7,345,921
Mississippi	44	43	13,441,400	7,120,000	6,321,400
Missouri	81	8	1,731,122	181,000	1,550,122
Montana	183	57	6,494,700	3,340,937	3,153,763
Nebraska	34	29	7,707,193	2,494,444	2,494,444
Nevada	13	3	8,848,000	6,197,700	2,650,300
New Hampshire	14	8	2,514,214	1,276,250	1,237,964
New Jersey	20	2	40,087,000	10,369,330	14,730,720
New Mexico	26	8	2,891,500	492,324	2,399,176
New York	46	17	85,424,100	42,956,415	42,467,685
North Carolina	69	9	5,180,700	3,446,000	1,734,700
North Dakota	113	27	4,821,420	2,745,650	2,075,770
Ohio	181	10	34,981,600	11,472,300	12,499,300
Oklahoma	74	9	13,907,000	7,764,186	6,142,814
Oregon	40	19	4,504,182	2,540,205	2,063,977
Pennsylvania	103	24	37,324,023	22,612,823	11,441,200
Rhode Island	2	2	5,615,400	3,127,200	2,488,200
South Carolina	37	30	17,911,400	7,716,000	10,195,400
South Dakota	27	18	4,344,900	3,171,376	2,071,524
Tennessee	43	40	37,397,493	21,426,320	16,112,173
Texas	229	113	49,722,814	13,279,841	37,442,973
Utah	44	4	4,241,823	1,700,140	2,541,683
Vermont	20	22	3,197,000	1,400,200	1,796,800
Virginia	31	16	5,193,400	3,448,000	3,007,400
Washington	81	15	2,112,822	1,212,811	9,209,242
West Virginia	42	8	4,403,800	3,545,361	3,034,234
Wisconsin	70	40	11,124,020	6,816,472	4,307,548
Wyoming	24	27	1,491,100	1,437,300	1,071,210
Total All States and Territories	3,621	5,139	\$1,714,488,420	\$464,717,336	\$1,249,771,084
U. S. Total	3,646	5,161	\$1,718,448,440	\$466,665,024	\$1,251,783,416

Source: Survey by Airport Executives Council, American Association of Airport Executives and National Association of State Airport Officials.

STEVENS GLASS FABRICS

STEVENS HIGH MODULUS GLASS FABRICS FOR NEW JET LINER

Forward thinking engineers specified Stevens patented High Modulus glass fabrics as the reinforcement for the cargo liner laminate approved for the new Boeing 727 intermediate jet. Stevens High Modulus fabrics are based on a unique weave pattern interlocking interlocking of the structural yarns. This results in laminates yielding maximum strength. Their high strength weight ratio and great impact resistance indicate tremendous potential in the aircraft and missile industry.

Stevens engineers are available for consultation. Why not explore the advantages High Modulus fabric may provide for your product.



Cross section of the Boeing 727 cargo liner shows High Modulus glass fabric.



J. P. Stevens & Co., Inc.

INDUSTRIAL GLASS FABRICS DEPARTMENT
Division of J. P. Stevens, Inc., New York 36, New York, Edward Lane
100 East Pine Street, Los Angeles 13, California, ALberta 4-6781

FINE FABRICS MADE IN AMERICA SINCE 1813

SHORTLINES

►Aerobol has replaced its E-2 and F-14 aircraft with the de-orbiting, 80-ton An-124A transport in polar air routes because the smaller air craft were unable to carry the required heavy loads.

►American Airlines reports 4.5 months per 1,000 hr of flying time for the International Telephone and Telegraph Federal Laboratories' detuning warning equipment cleared its jet fleet.

►American Airlines will provide 17 coach and 51 first class seats on its 747-200 transport aircraft after Jan. 17. American's 747 fleet currently have 65 first class seats.

►Boeing Airways night coach loads face plan has Civil Aeronautics Board approval for a six-month trial. Under the hourly plan, the load of a coach purchase one half night coach fare, and first class and all children under 21 or travel at 50% of the night coach fare. Children from two to 12 in old air at 25% of the fare.

►Civil Aeronautics Board will use a 95 percent maximum as a basis for future charter exemption applications for L-1049 Super Constellation aircraft through the aircraft currently carries 91 percent.

►Boeing has filed for bids on the construction of a new maintenance shop at El Alto, a suburb of La Paz.

►Continental Airlines is operating 6.25 million seat miles daily this summer—1 million more than last year's peak, 51 percent.

►Eastern Air Lines reports a 53% increase in revenue and a 40% increase in passenger for freight carried during May over the same month last year.

►Federal Aviation Agency has asked cockpit business firms to submit bids by July 15 for construction of an 80,000 sq ft building, a terminal, equipment and personnel building and a vehicle maintenance building for servicing mobile launchers and other support vehicles at Dallas International Airport near Washington, D. C.

►Lufthansa German Airlines has opened a ticket office in Denver's Alamosa Hotel as part of Lufthansa's expansion program in the West.

►Northwest Airlines has begun service with Boeing 708 jet transport, between Minneapolis-St. Paul and Chicago and between Minneapolis-St. Paul and New York, via Milwaukee. Initial schedules call for one round trip flight daily between each pair of cities.

AIRLINE OBSERVER

►One cannot expect of supersonic transport design is aimed at efficient cruise regimes in both supersonic and subsonic flight. Hence, first the sonic boom may not be overcome, cruise has led to the concept. At least one engine manufacturer thinks that penetration can be made adaptable enough to give economical operation in both light speed regimes.

►Competitive battle between Alaska and Hawaiian Airlines has evolved into a public debate over the merits of high-wing or low-wing aircraft. Alaska's newspaper advertisements have been winning the widespread view possible from each window in the high-wing design. Hawaiian is countering with an advertisement, which at least one can understand, with the Alaska advertisement, that emphasizes the safety factor of low-wing aircraft in overcast flights. The Hawaiian sales pitch reads in part that "only Hawaiian flies low wing Super Constellation for dependability over cloud water, preferred by aviation centers throughout the world. The other's above the wing."

►East, Inc. and Sud Aviation have signed an agreement to develop a completely automatic landing system for the Canadair tailjet transport. The system will utilize ground signals that will be led by a landing computer into the autopilot.

►United Air Lines is studying possibilities of installing seating gear for its Boeing 727 medium-range transport. United is speculating in Boeing calls for extra structural strength is seen likely to lower the amount of structural loading loads. Device under consideration will be similar to its aircraft carrier cross deck gunner, but chances are that this was would be caught in the loading gear rather than by a tail hook. Landing gear would require less structural strengthening to cope with landing load than would require systems to handle a tail hook, as the weight penalty would be less.

►Early traffic indication point is a remarkable coach for the Lockheed Electric Transport transport with wing, wing and engine nacelle modifications. Most carriers report high load factors on Electric operating over major routes.

►Federal Aviation Agency has commissioned a Doppler VOR at Miraflores, Mich. and will commission a second unit at Kilahe Island near La Grulla Field, New York, about the low Vague. Doppler VOR permits the location of a VOR unit in areas where obstructions such as buildings, no tanks or bridges—in the case of Kilahe Island—would make a standard VOR inefficient.

►Aerobol will double the size of its aircraft fleet by 1965, and approximately 55 new Russian aircraft will be in full operation by then. At the present time, 200 of the airline's 2,000 aircraft are either transport or freight powered.

►Three Brandon crews—Pete de Bont, Reid and Vargowill—will represent an organizational unit in a contract operating unit. The contract was won by recommendation by Board's President James Goodrich.

►Air Line Pilots Assn. has protested a Civil Aeronautics Board decision denying the union's request to intervene in the temporary rate rate proceeding for Southern Airways. ALPA President C. N. Saxon charged that the federal government has continued to subsidize Southern's workers at the expense of the airline industry by denying the union's management in meeting standards of "safety, efficiency and economy."

►Japanese bid for an around the world route for Japan Air Lines received a setback last week with State Department refusal to grant the carrier a New York Foreign route. U. S. will consider extending Japan Air Lines' Pacific route from the West Coast to New York, but it is withholding rights beyond because of the large number of carriers already serving the North Atlantic. Negotiations were resumed June 18 without fixing a date for resumption.



First!

SEPTEMBER 1, 1927 CONCORD, CALIFORNIA

YESTERDAY—a Boeing 49-B2 soared up and to the east as throngs of people witnessed the opening of a new era in commercial aviation—the first coast-to-coast passenger flight. Flying at the incredible speed of 150 mph, two passengers and cargo were landed in New York 35 hours later. The first—Standard Oil of California's first.

This historic coast-to-coast flight by United Air Lines' ferryman, Boeing Air Transport, marked another Standard "first"—one of a continuing series of pioneering achievements.

TODAY Standard Oil of California's first coast-to-coast in less than 6 hours—give safe, dependable performance for commercial, business, and private pilots throughout the West. Standard Oil's research and development has helped lead the way in aviation... it's developing new products for tomorrow's aviation achievements.

From "Jetsons" to jets—the development of superior quality aviation products. **STANDARD IS FIRST!**



Chassis design
Designs also bring
out of first plant
out of first plant
out of first plant

STANDARD OIL COMPANY OF CALIFORNIA

Airline Traffic—April, 1961

	Revenue Passengers	Revenue Passenger Miles (RPM)	Passenger Load Factor %	# of Mail Flights	Revenue Pass-Miles	Weight Ton-Miles	Total Revenue Passenger-Miles	Over-all Revenue Load Factor %
DOMESTIC TRAFFIC								
American	419,239	491,437	49.1	8,298,324	291,798	9,712,419	28,556,584	55.8
Boeing	115,079	120,399	29.3	191,353	153,411	193,413	9,333,513	48.2
Capital	302,464	122,434	36.1	246,131	276,232	472,107	12,548,526	49.2
Continental	215,140	20,841	38.9	196,577	196,577	196,577	196,577	38.4
Delta	316,437	312,837	46.7	36,110	277,112	1,199,894	28,698,793	33.0
Eastern	481,342	372,324	33.9	1,137,361	142,308	3,283,139	39,697,181	43.4
Northwest	126,274	73,724	34.4	126,274	48,377	310,476	7,107,338	44.3
Northwest	47,291	42,234	40.4	364,376	40,431	445,217	3,796,447	46.0
Texas World	316,339	188,141	38.9	1,481,484	492,232	4,197,343	38,153,294	40.4
United	479,493	479,267	40.9	2,413,130	1,022,837	7,180,028	37,814,867	39.0
Western	84,433	80,616	44.9	147,344	72,313	314,765	3,148,497	43.9
INTERNATIONAL								
American	7,471	4,233	37.5	5,289	1,706	295,127	3,140,868	38.9
Boeing	4,712	10,104	41.8	37,377	111,321	1,338,390	20,101,771	40.1
Continental	45,430	3,403	48.4	3,208	8,434	373,130	42,101,771	47.1
Delta	1,303	1,739	37.7	1,739	1,739	1,739	1,739	36.8
Eastern	47,129	70,724	43.9	184,414	422,542	7,116,708	32,401,771	40.4
Northwest	11,149	2,430	31.1	180	8,498	858,511	42,401,771	42.4
Northwest	10,402	10,701	41.8	1,334,070	1,478	218,534	4,314,173	44.8
Pan American	4,159	4,334	49.1	34,440	3,539	138,794	649,524	46.6
Alaska	121,129	103,086	40.9	2,148,410	6,301,488	28,744,881	47,401,771	47.4
Alaska	64,248	58,148	39.9	441,313	5,083,711	18,891,191	39,901,771	46.9
Pan Am	45,990	179,214	72.3	2,381,412	2,381,412	23,191,297	43,901,771	43.9
Pan Am	10,430	18,143	48.8	10,584	434,013	2,844,096	38,701,771	38.7
South Pacific	317	849	40.4	5,146	3,147	81,763	56,801,771	56.8
Texas World	11,415	10,447	42.3	1,217,894	2,729,277	10,629,724	46,901,771	46.9
United	12,120	30,341	47.7	220,471	1,022,837	2,381,538	38,301,771	38.3
Western	2,311	3,394	41.7	2,444	33,055	489,567	57,901,771	57.9
LOCAL SERVICE								
Boeing	47,837	14,313	48.9	30,140	30,140	64,599	1,401,831	44.9
Boeing	16,008	6,230	40.9	7,799	2,311	12,251	101,292	39.9
Continental	19,321	3,733	38.1	12,418	7,637	18,310	384,489	49.7
Continental	31,791	3,103	34.3	6,738	10,828	108,287	33,301,771	33.3
Northwest	28,303	11,627	44.4	8,370	21,834	1,177,389	64,101,771	64.1
Northwest	78,130	10,761	44.0	44,535	38,213	1,484,762	42,901,771	42.9
South Pacific	47,014	9,403	44.5	21,247	25,348	300,496	61,001,771	61.0
South Pacific	47,837	3,764	41.8	10,547	15,299	10,430	788,727	46.9
Southwest	31,710	2,793	34.3	23,201	11,763	426,480	33,901,771	33.9
Texas World	27,043	4,364	48.4	21,033	11,779	38,514	479,260	46.5
Western	36,133	7,267	41.3	13,177	4,461	17,489	372,132	41.4
HAWAIIAN								
Alaska	31,940	3,739	40.7	3,611	6,751	316,891	32,701,771	32.7
Alaska	36,261	2,101	40.4	4,138	126,538	554,615	56,401,771	56.4
CARIBBEAN								
American	3,216	12,193	48.5	34,899	33,739	11,400,193	11,500,834	77.9
Boeing	1,867	11,429	37.4	1,867	2,309,469	2,446,494	54,301,771	54.3
HELICOPTER SERVICE								
Chicago Helicopter	10,716	846	38.9	5,129	3,291	34,127	33,701,771	33.7
Los Angeles Airways	5,449	110	26.0	2,347	929	30,494	61,701,771	61.7
New York Airways	12,401	345	58.4	1,456	139	38,301	34,901,771	34.9
ALASKA SERVICE								
Alaska Air Lines	8,303	7,432	41.5	48,131	3,639	595,444	1,237,237	43.4
Alaska Coastal	3,673	310	26.9	2,827	2,420	40,376	49,101,771	49.1
Continental	1,121	203	40.4	4,474	48,637	74,799	99,901,771	99.9
Delta	788	32	3.1	1,323	2,341	34,377	41,801,771	41.8
Eastern	872	36	36.3	373	643	4,471	34,301,771	34.3
Northwest	1,303	517	40.6	51,514	10,333	183,410	47,401,771	47.4
Western Coastland	8,303	7,432	41.5	119,239	422,197	1,588,292	42,401,771	42.4
Western Coastland	883	1,107	39.9	14,517	79,341	294,287	38,301,771	38.3
Western Coastland	3,120	271	33.9	48,540	117,854	274,718	51,101,771	51.1
Western Coastland	5,139	207	46.8	247	263	38,638	46,301,771	46.3

* Not reported

* National has suspended service in Western, so only International route

Compiled by AIRCRAFT NEWS from data supplied by the Civil Aeronautics Board

* Operations suspended

Cargo and Local Service Airlines

List Officer, Director Salaries

Washington—Following is a list of senior officers' salaries, bonuses and in-kind compensation, expenses, and stockholdings for the year ending Dec. 31, 1980, as filed with the CAR.

[illegible][illegible][illegible]

Following these were call for members removed during 1997: Clark, Kent & Clark, Inc. 91-292; Rogers & Smith, Inc. 91-034; West Coast Co. 91-044; W. H. Smith 91-011; Air Transportation Assoc. 91-044.

Proc. 11th Int. Symp. on Space & Man (Sept. 87) 149
 Kluwer Academic Publishers, Dordrecht, 1988.

[illegible]

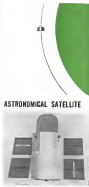
Kalman, Jay president and director, no salary; DAID shares of common stock, 2.5 M. Schuman, executive secretary, no salary, no stock; F. E. Anderson, director, no salary, 1,041 shares of common stock; R. E. Hixson, director, 1,451 shares of common stock; C. F. Gaudreau, director, no salary, 1,080 shares of common stock; G. Gaudreau, director, no salary, 1,080 shares of common stock.

[illegible]

J. M. Wainman, member air conditioning union
\$8,776 salary as clerk 1984 retirement C
D. Reed, member UAW providing services
\$20,448 salary plus work 1975 department
K. A. Stinson, member UAW, railroad division

[illegible]

Kryoner, Iar, Gherardo R. Boccia, 2022
Indefinite, 101 101 United Kingdom
Financial survey 101 101 101 101
101 101 101 101 101 101 101 101
101 101 101 101 101 101 101 101
101 101 101 101 101 101 101 101



ASTRONOMICAL SATELLITE

National Aeronautics and Space Administration's Astronomical Observatory will be launched 500 miles into space in 1963. It will orbit above the atmosphere, observing stars, planets, and galaxies.

Initial Stabilization—Within five hours after reaching orbit, the Astronomical Satellite's structure and control sys-

Reference to a predetermined star pattern will verify orbital stabilization.

Website Development. Next, the website will be posted and held in within 17 weeks of AEC, using feedback from the system's air site trackers. Feedback from experimental optics will then be used to stabilize the satellite within 0.1 sec of its use.

General Electric's Missile and Space Vehicle Department is developing the stabilizor and control system for the Astronomical Satellite. Similar systems for ATLAS and Thor twenty vehicles, and Arrow and Nimbus satellites have all ready been designed by MSRD . . . a department of the G.E. Defense Electronics Division.

GE-100

GENERAL ELECTRIC



ASTRONOMICAL SATELLITE will orbit beyond Earth's atmosphere: haze—
tropic barrier to man's study of stars. Once this NASA satellite is stabilized
in orbit, its ground-controlled telescopic and electronic equipment can
automatically observe, collect and transmit data. The control and stabilization
system for this orbiting astronomical observatory is being developed by
General Electric's Missile and Space Vehicle Department for Grumman Air-
craft Engineering Corporation, prime contractor for the Astronomical Satellite.

GENERAL  ELECTRIC

GENERAL ELECTRIC

GENERAL ELECTRIC

MISSILE AND SPACE VEHICLE DEVELOPMENT, P-1



Mach 3 Technology

Torturing aircraft structures with the world's largest "gramophone"

To predetermine full-flight stresses on an aircraft as advanced as the Air Force's Mach 3 B-70 Valkyrie, it was necessary to make sweeping advances in the state-of-the-art of testing procedures.

One way the Los Angeles Division of North American Aviation met this challenge was to build the largest, loudest acoustical test chamber in the world. Here, a 47-foot x 30-foot concrete loudspeaker horn can blast aircraft structural specimens with up to 170 decibels of noise. This is the equivalent of 50,000 fire-tube radiators going full blast, yet legions of soundproofing keep this noise to no more than a distant whisper outside the lab. The noise inside the lab is so great that the best generated sound ignites fiber glass insulating material.

Builders of the B-70 Valkyrie

Specimens up to 6 feet by 25 feet can be tested in the acoustical lab. It has the capacity for progressive wave as well as conventional sound fields, grazing or normal incidence specimen orientation, discrete frequency or random noise at sound levels up to 170 db; thermal environment testing from -100°F to +1200°F; frequencies of 50 to 10,000 cycles per second. This is indeed a remarkable facility for acoustical testing, fatigue testing, and vibration testing.

This giant acoustical laboratory can not only carry out testing on tomorrow's Mach 3 aircraft, but can perform tests on aerospace craft until ten years from reality. The lab is only one of the money that the Los Angeles Division has developed to conquer problems of space age flight.

THE LOS ANGELES DIVISION OF NORTH AMERICAN AVIATION



ducts, allowing bouncing echoes as speed built up. It was possible, however, to hold steady and level a strong beam but at the expense of one admissible full force on the wheel. Force required is not high enough for real freedom of FPG to be a "no go" area in autogate operation.

Stabilize trim is accomplished either by a three-ported valve on the control wheel or by one of a conventional loaded trim system on the center poles of. But three-ported system trim is not included in the DC-3 as the trim of a four-way switch, i.e., fore and aft for elevator trim, side to side for aileron trim is necessary to reach the aileron trim knob with the right hand and the position is accurately aimed using the knob is located behind the glass of the pilot's seat back.

Reverses from photo-induced instability such as Dutch roll was accomplished by straight forward techniques both manual and on automatic, i.e., wing level by use of aileron was stopped by use of rudder.

Trimming reversing a few effects could be a few seconds before the legated no and be even without any external cause down. Operation is powerfully powered and designed fully so that any malfunctions in the system will cause the reaction to fail in the "off" position. Automatic is equal with only a hand pump at all times accurately while the mechanism is in operation. Position light as the is automatic panel let the pilot leave the reverse position.

In flight, members two and three engines can be operated in reverse thrust up to maximum continuous power ensuring their rapid descent can be made in case of emergency. Lockout devices prevent members one and two engines from being reversed unless there is a warning on the landing gear.

The DC-3 employs an other high speed drag or landing device after that thrust reversal which appears to come from buffeting and subject from changes down speed as other speed brakes.

Emergency descent was demonstrated while at 31,800 ft. from a cruise speed near Mach 0.68. All engines were cut in side and the three thrust reversers on the inboards were pulled back, as soon as two and three slowed to side. Once the attention lights showed that the reverse gear was complete, noise from the inboards was applied to the inboards which was very severe to maintain 0.68 Mach number or the maximum limit speed. Flare angle is near 10 deg and the city of descent about 13,000 feet. Descent from 41,900 to 12,000 can be made in the same time as less than 2.5 min.

Leaving all engines at 31,900 ft., an screen consisting of steep banks with one and two engines out were made

with the bank on rudder and aileron coordinated. Although not capable of rolling with light flare angle as that state, the DC-3 was safely controlled through all necessary maneuvers.

One landing was made at Ontario International Airport to check the time coming of the automatic approach complex with the ILS. Descented by sea level at 180 ft. with flap up. The aircraft's gross weight is, the time was 173,000 lb. Flaps were locked to 25 deg and speed reduced to 145 kts. prior to commencing the manual landing. The engine worked very well despite the noise test of approaching the field at a 60 deg angle. At glide slope interception, aircraft was accelerated to 115 kts in five steps were level to 90 deg. Automatic approach was discontinued at the middle marker and a visual landing executed without additional trim from approach speed. Flare speed for this weight was 121 kts. Lateral control was required as "loading" on the pilot's part.

Conventional Landing

The DC-3 is landed in a nose wheel manner with the attitude of nose wing steady as the approach. Banked off, much as the procedure with straight-wing aircraft. It is in every respect an easy aircraft to land and does not require any concentration of thinking. Once the nose gear is down on the ground the nose gear is lowered, whereas the wing spoilers automatically deploy, providing the cockpit's service has been placed in the desired position. Therefore control is basically maintained with the engine nose gear during the rudder pedal recovery as transition to the hand wheel.

Reverses are put into operation and when the maximum light indicates all four are positive, reverse thrust is applied. Maximum continuous power can be applied to all four engines down to a speed of about 70 kts. Below that, foreign object ingestion may occur and thrust is reduced to reverse idle except as an emergency.

Takeoff from Ontario at 173,000 lb. was conducted with maximum thrust and two engines retarded to idle after passing V speed. Directional control was maintained without trouble and rudder force was not excessive on the threshold.

Two landings were made at Long Beach, one on each of the separate fields. Gross weight on landing after the first flight was about 173,000 lb. for which the bank showed three speed to be 174 kts.

Second landing at Long Beach was made by this time made with some fluctuations with the attitude. Flare speed was 141 kts, 121 kts, and the sharp transition capability was demonstrated in order to trim and back track on the active runway.

POLARIS PROVEN CONNECTORS

LIONEL

Series WM-20

Extra Reliability With—

- Rugged Die-Cast Housings
- Double Flange Holes
- Beryllium Copper Contacts
- For Extended Insertion/Withdrawal Life



Five sizes, 36 to 164 contact range • Also available for #16 wire terminals • Most applicable MIL specs • Materials & specifications modified to meet your special needs—

• Write for Series WM-20 Dimensional Data Sheet



Lionel Electronic Laboratories

(Formerly Atlas Electronic Laboratory)

1255 Phonyang Ave.
Brooklyn 25, N. Y.



GLASS FIBER and turbo model has been dropped from 4,000 ft to test spin characteristics of Hawley Page 135 low-speed, 4500 rpm motorcraft, due to its this country. Engineers say the 315 will be difficult to spin. Normal recovery means an obstacle.

British Study Space, Supersonic Craft

By Herbert J. Cohen

Farnborough-Britain's Royal Aircraft Establishment is working on a wide variety of designs ranging from space vehicles to supersonic problems of supersonic transport.

In a limited showing RAE engineers revealed some aspects of studies that cover investigation of high angle of incidence regimes such as in the Hawley Page 135 spin drive engine due to its use in the wing design of bomb containers. The Establishment said with its 6,000 engines (1,600 of them accurate) at Farnborough, Bedford, Newport, Llandow, West Farnham and Luton. The latter stations are mostly concerned with engine and engine testing.

At Bedford, engineers are using wind tunnels from low speed to high speed, to test VTOL models buffer effects in thrust over controls, such as bank, bank, and maneuverability of shock patterns using the Schlieren technique. Considerable stress test work on the Mach 3 Bristol T.155 has been done at Farnborough and Bedford.

Expanding into the field of small supersonic propulsion for pilots, Farnborough has developed a wing system using drop wings of 1-2 m, or more, fitted in a carrier. The carrier is transmitted from a dropper and to the cockpit. The idea is formalized by K. R. Shook, principal research officer and the unit was designed by E. W. Dunn. The device has been flown up to 1,500 ft and is on its way.

The design shows the engine's ground position and track superimposed on the correct topographical map in a circular area of about 45 miles. The scale can be either 1:500,000 or 1:1,000,000.

This design is driven from a variety of input systems which contain data with heading to determine the track, ground speed is marked into north-west and east-west components.

The computer also has a camera that for navigation in flight through the atmosphere across the whole of Europe, as well as North Africa is contained on a 9-ft film roll which can be controlled in the field. The instrument is a first flight design in February, 1966. Ground control is by radio to 1. Miles Ltd. Commercial speech has not yet been explained.

Recent Activities

In recent times the Royal Aircraft Establishment has directed many of its attention and capabilities toward major aerodynamic investigations and the life sciences, according to M. J. Lightfield, director. This work has resulted in development of cabin pressurization devices and a Type B full-pressure seat and when other pressure is low.

The end is lightweight and consists of a ribbed metal frame over front, two, two, two, and a folding helmet with a transparent helmet window which maps out over the pilot's head in an emergency. The net weighs only about 12 lb and gives the pilot a high degree of mobility.

Lightfield and considerable emphasis now is given to supersonic transport in conjunction with French ONERA, the British are working on a long range model of a Mach 3 jet airplane and the French are interested in making supersonic transport. Lightfield predicted a supersonic transport will be built



BLACK KNIGHT rocket motor (left), can reach 1,000-ft altitude. Model communication satellite (right) has solar battery.



within five years and could be in service before 1970 at operating costs comparable with today's jet jets.

In other transport applications Lightfield and the Farnborough team are working on modifications to jet engines on the Rotavator VTOL transport and concluded that "difficult task with more as this aircraft can be resolved."

Turning to space, Lightfield said RAE is "putting all our weight on this," and continued development of a communication satellite in conjunction with the British General Post Office. Successful testing of such a device, Lightfield emphasized, would put Britain in a good negotiating position with other countries. He was opposed to "putting a dead weight in orbit," concluding that any device "must work for you to be of any use."

Paddleshell Design

One communication design, which RAE personnel termed as such a "paddleshell" in the field is the last blacked paddleshell type with solar batteries centered in the paddles and communication equipment in the blade tips. Fuel would be in the hull and probably would be some form of propane. RAE and the satellite would be stabilized in relation to earth and 400 channels of communication would be available in this particular concept.

Lightfield and satellites such as this could be put in orbit using the de-

scribed Black Knight as a first step, plus the French Venerable and another unnamed study a proposal which has been printed for a European conference of interest by Minister of Aviation Peter Thorneycroft.

Flight Tests

Farnborough does considerable light test work and currently is flying an Area 707C in conjunction of electrical control systems. The aircraft is a tandem two-seater with right seat section fitted with control electrical pick-off which actuates hydraulic controls. A Valiant also is being used for various

Rise Steel standard load-bearing tests.

Cost effects on helicopter rotor blades are being studied on a Bristol Sycamore helicopter, with an instrumented by Hawley Page 135 wing used to make photographic and electronic measurements in often adverse conditions.

Another test project involves a Gloster Javelin fitted with a device trapping blood engine air to blow out all the plant's windshield. This engine has flown considerable hours in test facility, equipped at Singapore, records mounted on the wing were re-



EXPLOSIVE DECOMPRESSION effects are studied in cabin corresponding to Victor and Valiant engine shown by Britain's Royal Aircraft Establishment.



WIND TUNNEL MODEL, tested low drag conditions for design of Mach 3 jet transport. British are co-operating with French counterpart, ONERA.



Space-Age Project "HEAT FOIL"

A CHEMICAL EXPEDITION...

...searching for plastics materials that can "take" temperatures of 20,000° F. plus

Monsanto has developed high-heat-resistant resins for laminates that remain intact for upwards of 2-3 minutes at temperatures as high as 20,000° F.; that maintain integrity for 200 hours at 400° F. Under evaluation are plastics laminates that hold promise for rocket nose cones, nozzles, and other components exposed to high heat.

structural integrity under high-heat stress. Like other, more common reinforced plastics, the new heat-resistant laminates have exceptional mechanical strength. The following table illustrates some of the mechanical properties obtained with a 1/2" series of a laminate made with a Monsanto flame-modified phenol-formaldehyde resin.

By applying basic knowledge of polymer chemistry to the problem of service life under heat, Monsanto is making new breakthroughs on the problem of high-heat resistance with plastics. One of the most promising plastics now being evaluated is a flame-modified phenol-formaldehyde resin which makes laminates and moldings that retain integrity after hundreds of hours of exposure to temperatures of 100-600° F. Still other polymers under development hold promise for broadening temperature resistance for increasing lengths of time.

MOLECULAR DISSOCIATION SETS UP COOLING ACTION

Some resins under study form a char layer which insulates the interior and radiates a large portion of frictional energy. Plastics laminates made from such resins provide insulating walls for interior surfaces or armor.

HEAT RESISTANCE—PLUS STRENGTH AND LIGHT WEIGHT

As in many other fields, laboratory tests for space-vehicle science are hard to correlate with actual field performances. In standard Charpy-type Tests and Stab-In-Arc Tests, heat-resistant plastics laminates show adequate retention of

Property	Results	MS-A-0109 Specimen
Flexural Modulus Standard Condition 73° F. 30 Day Water Immersion In Air @ 500° F. 100 hrs. @ 500° F. 200 hrs. @ 600° F.	75,000 psi 75,000 psi 60,000 psi 51,000 psi 23,000 psi	50,000 40,000 40,000 20,000 No Spec.
Modulus of Elasticity Standard Condition 73° F. 30 Day Water Immersion 100 hrs. @ 500° F. 200 hrs. @ 600° F.	5.75 x 10 ⁶ 3.45 x 10 ⁶ 3.28 x 10 ⁶ 1.48 x 10 ⁶	3.0 x 10 ⁶ 2.45 x 10 ⁶ 2.0 x 10 ⁶ No Spec.
Tensile Strength Standard Condition 73° F. 30 Day Water Immersion 100 hrs. @ 500° F.	43,000 psi 45,000 psi 23,000 psi	40,000 38,000 No Spec.
Compressive Strength Standard Condition 73° F. 30 Day Water Immersion 100 hrs. @ 500° F.	50,000 psi 45,000 psi 8,040 psi	35,000 28,000 No Spec.
Barrel Hardness	76	55
Permeability	5 cc/24 hrs./sq.in.	1.0 mm.

Mechanical Properties of Redwood® SC-1010 Laminates: 1/2" section F.C.S. 1211-181, 1/2" thick, 12 x 12 in., 200-psi pressure rated, 1 hr. @ 2100° F., and cured to gradients of 30° F./24 hrs. each to 200° F.; resin soaked 24 hrs.
[Data cannot not be specified by MS-A-0109]

COMMERCIAL PROMISE, TOO!

In addition to the properties described, the plastics laminates created for high-heat resistance are practically immune to fuels, oils, and solvents.

(Please turn page)

OUTSTANDING ELECTRICAL PROPERTIES

Heat-resistant plastics laminates have also shown outstanding performance in electronic applications wherever frequent cycles of heat and cold are a problem. While maintaining mechanical strength, plastic laminates (as described) showed no degradation of dielectric constant or loss tangent. The following table shows results on a typical panel after various numbers of cycles of heating for one hour at 550° F., then cooling 1½ hour to room temperature.

ELECTRICAL PROPERTIES AFTER HEATING
(Approximately 500°C Recycled Cycle)

Room Temperature Electrical Properties		
No. of Cycles at 550° F. for 1 hr.	Dielectric Constant	Loss Tangent
0	4.8087	0.0012
100	4.7389	0.0018
150	4.7317	0.0018
200	4.7248	0.0014

OPTIMUM PARTS PERFORMANCE

In fabricating parts for optimum performance under high-heat conditions—fiberglass, glass, asbestos, or nylon is impregnated with resin, is molded, filament-wound or laminated by any of several methods, then cured.

THE CONTINUING SEARCH

Project "Heat-Foil" is a continuing study of means for high-heat resistance and of means whose energy of dissemination makes them outstanding for high-temperature applications. This search will continue to develop materials that will help answer the high-heat requirements of a space age, in defense and industry. MONTANO CHEMICAL COMPANY, Department AV-6, C Building, St. Louis 60, Missouri.

Monsanto Space-Age Projects for Government and Industry

- High-Temperature Hydraulic Fluids
- Coolant Dielectrics for Electronic Equipment
- High Temperature Plastics
- Improved Nitrogen Oxidizers for Solid Propellants
- Fire Resistant Structural Plastics
- Hydrocarbon Fuels for Jets and Missiles
- Fire-Resistant Hydraulic Fluids for Ground-Support and Missile Launching Equipment
- Radiation-Resistant Waste Treatment Fluids
- High Temperature Lubricants and Additives
- Radiation-Resistant Reactor Coolants
- Moderators
- Intermediate-Semiconductor Materials
- Pure Silicon for Transistors, Rectifiers, Diodes
- Ultra-Fine Metal Cores
- Materials for Vibration Damping
- Heat-Resistant Resins for Laminating and Bonding
- Inorganic Polymers
- High Energy Solid Propellants

You are invited to work with Monsanto on your materials needs in the above fields.



progress and, in some cases, windblast damage due to driving into and back.

Fairbanks's Mustang, and Phoenix Department is working on metal fatigue and buffing with emphasis on recovery of titanium and aluminum stress for aerospace applications in which low temperatures could exceed 100°C in kinetic heating. Research on high-temperature materials is presently confined on graphite and carbon fibers.

The Phoenix Department is exploring the metal stages of landing of a single engine under cyclic stress, and problems of surface diffusion and of thermal expansion at high temperatures. Another study is of association of gas molecules with solid surfaces.

A high speed track, for tests of civil aircraft powerplant tests, similar to those used in B-57C, is being developed by Phoenix project. Scientists involved on a rocket-

jet propelled truck which accelerates to about 30 mph and is stopped by a hydrostatic driver utilizing a vented cylinder on the truck and a tapered steel piston which is at the end of the truck.

Deceleration is about 6g in 54 ft. Two diameters limit the truck which are strain gaged and connected to accelerometers by trailing cables. Engineers will seek to test in the wind tunnel and in actual crashes of up-to-4g forces.

Shown for the first time was an air launched target developed by the RFD Co. Company Ltd. of Golding and Angle tested in RAF on a circular aircraft. The circular target is pushed in a light alloy container fitted in a wing pylon on the Meteor and can be fired after ejection, in an 800 ft. cycle. cost. Attraction search pick up the target from 500 yards is being in on a radar reflector. Entry cost roughly 777 lb.

being, inspection and maintenance there is still no way of controlling operating procedures and operating environment.

These two factors weigh heavily in the design of a vehicle and are major causes for the wide variety that occur in blade life.

Because no designer can control these two items, looking across the development picture for a combination of test and calculation, a designer is able to get better control over his design, but he still lacks absolute control. For that reason, life figures are mapped after they have been calculated, measured, tested.

Current Requirements

This is the basic for current regulations which blades are tested at 1,900 ft. or less, that engine be overhaul at stipulated intervals or first overhaul be imposed at certain intervals. But in most designs, during all blades are at 2,900 ft. in life flying out at a level of 100 mph, because one engine can operate after blades do not have the usual fatigue life. In using the traditional approach to life expectancy problems, calculations and tests will show that failures can be expected after certain intervals.

So an arbitrary life limit is set below the calculated and tested section, on the theory that this is conservative. It is also possible the larger portion of the stress which wouldn't have failed at that level.

Sampling techniques, which are the basis of testing, do not extrapolate well to the whole quantity of items involved. The strategy is to get some kind of an interval at about 10% of the total to place Skolnik's approach has been to develop the life life which shows by indicating a low of internal blade position—that a crack has started and that the blade be replaced.

This sample approach is expected to pay dividends in operation, and to lead back, initial information to designers for checking their calculations.

Hurricane Mesa To Remain Open

Los Angeles—Plans to shut down Air Force Hurricane Mesa operations on Monday, 10, Utah have been called off. Coleman Engineering Co., the track operating contractor reported.

As F-100 had ordered the track, closed by June 10 because of deteriorating road conditions of one external aircraft escape system.

Report by the contractor of a \$100,000 contract for enhanced testing of the B-1B escape capsule raises the fact that will arrive in operation, company president F. C. Coleman said.

Indicator on Pressurized Rotor Blades Warns of Crack Initiation

By David A. Audette

Startled, Cessna—Pressurized rotor blades bearing a tell tale device to indicate pressure loss due to crack initiation, will be delivered on the first commercial S-41s in Sikorsky Aircraft Division of United Aircraft Corp.

With the new inspection method, operators will be able to check blade condition during a simple inspection in ground air and pilots rather than having to pull the blades for a two-hour check of their integrity.

At last year's approval is obtained from Federal Aviation Agency—such new indicators will be able to see that blades, and the turbine indicator shows. This new rotor all blades regardless of condition, at 1,500 ft.

Both these factors—reduced inspection time and longer blade life—will effect major savings in direct operating costs of rotor wing craft.

Other Applications

Skolnik says all blades from now on will be processed. Subsequent to the S-41 installation in PAA was the first approach, following the S-41 installation, the blades also will be installed on the S-41 engine. U. S. Navy is now using change orders for the B-1B and B-1B models but the Army—will a large stack of spare replacement blades on hand—will quite reach to more.

B-1B blades—used for Blade Inspection Method—are interchangeable with current Sikorsky blades. They weigh about 2 lb per blade, more, but in-

terchangeability is effected by changing the non-B-1B blade balance weights.

Blade inspection is simple. The blade tip is pressurized to 10 psi, and a sample tell tale tape is bonded to the inherent root rib. Part of the pressure range from will be to check, usually, the portion of the turbine. If it shows all, there is a crack—somewhere on the blade and the blade can then be pulled and replaced.

After the rot indicator shows, there is still some life, is the blade—perhaps 50 to 100 hr—after that a helicopter at a secure base could safely be flown back to a maintenance station.

Operation using non-B-1B blades can send them back to Sikorsky for repair.

10 Years' Background

The B-1B approach is not suddenly new at Sikorsky—it dates back about three years, and can trace its origins about 10 years back.

It pointed to an inspection technique, growing out of the uncertainties of design. It is difficult to predict blade life, and more living designed the blade. There is nothing that can be done to change its life. Furthermore, the designer can't afford the luxury of high margin of strength, the blade has got to be designed with a life figure in mind.

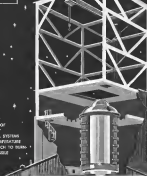
Blade life—air reliability—it is a function of stress random variables. It is a complex parts, production and inspection techniques, operating procedures on vibration measuring standards and maintenance techniques. With the inherent possible controls are all controllable variables—those of manufac-



BEECH "IMAGINUTY" IN *Cryogenics*



AT SQUARED, BEECH CRUISES A SANE "TREATMENT" THAT "IMAGINUTY" FIRST OF ITS KIND IN AMERICA. IN THE "ASTERO" "TRIST" TOWER, USED IN THE "ASTERO" (CAN BE GROUND-TESTED UNDER ALL ENVIRONMENTAL CONDITIONS) ENCOUNTERED HIGH LAUNCH TO BURN-OUT OF ACTUAL HYDROGEN FUELED MISSILE.



LIQUID HYDROGEN AT -423°F. IN INSULATED TANKS, WITH HEAT EXCHANGERS BY BEECH, IS FLOWED INTO SQUARED TOWER AT START OF TEST.

WHILE FUEL IS FLOWING, ONE AT A TIME, 1000 QUARTZ LAMPS CAN SCOUT HEAT TO 15,000°F. ALMOST INSTANTLY.

BEFORE TEST, ELECTRONIC COMPARISON GIVES INFORMATION OF VIBRA- TION TO FUTURE DESIGN OF COMPLEX CRYOGENIC AND EXTERNAL AIR TREATMENT SYSTEMS.

Beech Aerospace Division
TRANSCIENT HEAT FACILITY

Space flights start here

Before the countdown that sends a giant Atlas or Titan ICBM sailing into space, vital propulsion system components of these mighty missiles are thoroughly proved their reliability at the production environmental testing facilities of Beech Aerospace Division near Boulder, Colorado. Here, in a 1,600-acre site near the Domain of Standards, cryogenic engineering laboratory, Beech has assembled a skilled, unified team of scientists, engineers and technicians.

Working with the most modern equipment available (much of it Beech-developed), this team has already made significant contributions to speed America's progress in space technology and advanced

weapons systems. Its achievements include noteworthy accomplishments in the fields of advanced propulsion systems and components, liquid hydrogen propellants and liquid hydrogen storage, research, development and fabrication of titanium tankage systems, and environmental testing of a wide range of missile components and systems to qualification.

Because of its experience and facilities, the Beech Aerospace Division team is uniquely qualified to accept many types of challenging new assignments and carry them through rapidly to successful conclusions. May we discuss with you how we may be of service?

Beech Aerospace Division, privately owned and operated since 1959, is a wholly owned subsidiary of the Beech Aircraft Corporation. The Division's facilities are located in Boulder, Colorado, and include a 1,600-acre site near the Domain of Standards, cryogenic engineering laboratory, and a 1,600-acre site near the Domain of Standards, cryogenic engineering laboratory. The Division's facilities are located in Boulder, Colorado, and include a 1,600-acre site near the Domain of Standards, cryogenic engineering laboratory, and a 1,600-acre site near the Domain of Standards, cryogenic engineering laboratory.

AVIONICS

Nuclear-Thermionic Power Unit Proposed

By Barry Miller

Placitas, Calif. — Concept of a compact nuclear thermionic power supply which does not require moving parts or fluids during its operation and whose design is sufficiently flexible to be tailored to meet different power requirements is being proposed to the Air Force Avionics Group Commission and the National Aeronautics and Space Administration by General Electric Co.

The powerplant, called STAR (Space Thermionic Auxiliary Reactor), is intended to satisfy the electric power needs of a wide and heterogeneous group of future manned and unmanned space vehicles. The STAR concept envisions a cylindrical power supply composed of a number of separate semi-conductor ring cells containing thermionic diodes, fuel elements and reflectors. Specific power requirements can be satisfied by adding enough rings to produce the desired power.

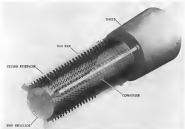
Convenient Gear

With the addition of a suitable conversion gear for boosting its relatively low voltage output, the STAR power plant also could satisfy the voltage requirements of an on-orbit propulsion engine, according to its designers here at the Volcanos Atomic Laboratory. Volcanos is the research center for General Electric's Atomic Power Equipment Department located in nearby San Jose.

General Electric is only one of several organizations working on nuclear thermionic conversion, and one of a still larger group concerned with the use of nuclear energy for space vehicle auxiliary power (AVS) (ENR 7/23 p. 69).

A STAR power plant, weighing about 1,000 lb. and capable of delivering 70 kilowatts of power could be used for flight in 1968. The concept, however, is flexible, it is now working among space and other government agencies. General Electric engineers say they estimate that a smaller 20-kilowatt prototype supply, fabricated in a step-by-step development of a light model, could be engineered for ground testing two years earlier. The cost of such a program for which preliminary engineering work is complete, would be between \$25 and \$50 million, these engineers estimate.

The STAR power supply employs the heat generated by nuclear fission in a fast spectrum cylindrical reactor as the heat source for the direct con-



COMPACT NUCLEAR THERMIONIC power supply, called STAR (Space Thermionic Auxiliary Reactor) could supply 70 kw. of electrical power for manned or unmanned space vehicle applications by 1968, according to its designers at GE. Power supply is composed of a number of rings containing fuel elements and preheated thermionic converters.

version of heat into electricity by thermionic conversion. The thermionic plasma diodes, or converters, are mounted in 1-in. wide circular rings with their cathodes in contact with the reactor's fuel elements and their anodes facing radially outward from the periphery of each ring.

A number of rings are semi-concentric to one another as part of a desired output. The diodes in each ring are in parallel.

Then, the final supply is a cylindrical shaped stack of 11-in. diameter rings supported by two bars. The length of the supply is a function of its desired output power. Three feet or longer for the next proposed design.

Current which acts as a focus of electron for the diode operation is provided for each diode by individual pin-shaped cesium resonator which extend from the outside surface of the converter. The cesium boron the work function of the cathode material, thereby enabling more electrons to escape from that electrode, and it is assumed that cesium with free electrons is added the space charge between the cathode and the anode.

Waste heat radiates from the anodes of the converter into two pipes with one carrying separate radiators of other heat transfer mechanisms.

At one end of the reactor is a reflector, also supported by the bar structure of the powerplant and protecting the reactor and the converters from damage by micrometeorites. A shadow shield at the opposite end of the reactor guards the space vehicle from radiation effects.

In operation, the powerplant could be housed on the end of a boom which would extend from the space vehicle. As a safety precaution, prior to launch, the reactor could be separated into two halves, each spherical. Then, during startup the two halves would be brought together into a critical state by mechanically positioning the end reflector. There would be no further need for moving parts.

The powerplant would be controlled by the negative temperature coefficient of the reactor.

Design Goal

As a design goal, General Electric engineers are striving for a year's operating lifetime for the supply.

Advantages of the STAR system, General Electric says, are:

- **Reliability**—STAR would possess the inherent reliability of a system which does not need moving parts to maintain its operation.
- **Flexibility**—Fabricating single STAR converters and fuel elements is indi-

AVIATION WEEK, July 18, 1961

THIS TAPE PLAYS BACK THE SOUND OF MONEY...



... and does it to the tune of more than 1,600 tape-led AMP In-Circuit Pin and Socket terminations per hour—sometimes even more, depending on operator dexterity! Lower cost, semi-skilled labor can easily handle not only the automatic termination of leads but also the loading of AMP In-Circuit Connector blocks. A simple insertion tool helps fill connector cavities faster than a dentist trying to get away for an afternoon of golf. When you take these advantages and add the controlled pressure crimp backed by AMP's twenty years of experience in the field of solderless termination techniques... you have connector performance of maximum reliability at the lowest installed cost in the industry. This is the winning combination you get with AMP In-Circuit Connectors... available in all sizes and configurations. Get all the facts? Write today!

AMP INCORPORATED

GENERAL OFFICES: HARRISBURG, PENNSYLVANIA

AMP products and company facilities are now fully through military conversion to an American Standard in Design & Quality & Supply & Service in Mass Production.



EXPERIMENT with plasma thermocouple is conducted in the Yulcolec Atomic Laboratory of General Electric's Atomic Power Equipment Department in connection with a nuclear thermocouple project for space vehicles.

initial modules, then assembling them into rings to constitute the basic building elements of the preprogrammed variable development and testing parallel detection of higher power level tests by adding more rings.

•Freedom from orientation—Orientation of the STM concept in space is not critical because its operating mechanism is not slightly affected by the earth's magnetic induction.

•Low shielding weight—By keeping the diameter of the reactor small the required shielding is the design was minimized. A gross shield weight as a function of nuclear diameter (assuming nuclear power of 1,000 kilowatts) and a 100 ft separation, prepared here, indicates that a 5 in increase in the diameter of the reactor would require an additional 500 lb of shielding for screened reactors.

•Microencapsulated potencies—Should one of the exposed control gas transducers be punctured and the gases escape, such a high concentration of fuel

would be open-circuited. Current for the ring would continue to flow because each reactor in the ring is in parallel, thereby decreasing the output of the system to one reactor's output.

•Independence of some gravity reactions—The preprogrammed fuel rods, tested in the first both circumstances, can pass signals to us, because the output is distributed in each reactor in a diffusion process that does not depend on acceleration. Another feature will be held liquid control in the reactor systems oriented in the coil of each tube.

•Self-shielding on varying loads—The reactor will operate at essentially constant temperatures, regardless of the load determined by the coil diam or velocity of the reactor and the value of the temperature coefficient. Fuel leakage will be extremely small compared with the total amount in the preprogrammed. The reactor can accept a load rising from open to shut or cut without an external control system. During open control operation

FACT

Flexible Automatic Circuit Tester

Cut the cost of circuit testing

Eliminate the costs of developing special purpose test equipment for each production program! Cut the time required to verify the wiring integrity of electrical assemblies! Reduce the amount of valuable floor space required for circuit test bays! With the Hughes developed **FACT**—short for Flexible Automatic Circuit Tester—you get a mobile, general purpose test unit that quickly detects and isolates continuity and high potential faults.

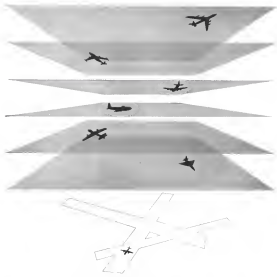
FACT is a high capacity unit—it can program complete tests on an unlimited number of circuits. **FACT** cuts down programming time dramatically—it uses standard IBM systems. **FACT** substantially reduces trouble shooting time.

FACT is self calibrating and self testing—thereby substantially increasing the confidence level of the circuit test.

FACT is production proven and available today. With these different **FACT** models (2 cord programmed and 1 tape programmed) Hughes can meet every circuit testing problem. Inquire today. Write to: L. W. Ranner, Hughes El Segundo, L.A. 45, California. Or better yet, call him at Oregon 6 0861. Ext. 1950.

THE HUGHES ELECTRIC COMPANY
HUGHES ELECTRIC COMPANY





Cubic MOPTAR—key to jet age collision avoidance



MOPTAR requires only the miniature transponder in each participating aircraft.

Using only miniature transponders, with no moving parts, a single Cubic MOPTAR ground station (like the ones already in operation) can be expanded to provide 3-dimensional position data on as many as 400 aircraft. The expanded system can provide terminal and enroute surveillance, positive aircraft identification, conflict prediction, and avoidance data. To avoid collisions, MOPTAR transponder information would be automatically and continuously processed, and potential conflict data transmitted to the aircraft involved. MOPTAR includes Collision Prediction (DME (Distance Measuring Equipment) and ANE (Angle Measuring Equipment)), was developed for the United States Air Force and the Federal Aviation Agency. For more information, write: Dept. A9-105, Cubic Corporation, San Diego 11, California.

EMERGENCY INFORMATION—When including paper App products in EOE or local inquiries from 10 p.m. to 10 p.m. call or write.



cubic
CORPORATION

SAN DIEGO 11, CALIFORNIA

heat is transferred from the fuel to heat conduction and radiation losses. When current flows, heat is transferred from the cathode to the anode by electron cooling. While this might lead to drop cathode temperature, resulting in a full temperature drop, the reactor temperature would remain its original level after the reactor increases power as a result of the positive reactivity effect caused by the fuel temperature drop.

Ground testing—The powerplant can be tested in a rapid test facility by connecting the reactor in a vacuum can. General Electric engineers completed a series of ground tests to determine performance characteristics based on these levels of converter technology. The first of these calculations is based on laboratory experiments completed in a general test, the second or prototype level is an estimate of the success in the reactor technology expected by the time the prototype powerplant is constructed, while the final set of performance figures represents use of advanced technology resulting from a vigorous development program continuing through launch qualification of the powerplant.

In each case, the weight (1,100 lb) and gross physical dimensions (16 in. long, 15 in. diameter) are identical. But the ability to operate at higher temperatures, largely made possible with improved materials, boosts the output power. Thus reducing the specific weight (weight per kilowatt) of the reactor. For the three cases cited above, the output power increases from 15 to 25 kilowatts and finally to 70 kilowatts for the final reactor. The specific weight for the three respective cases would be 300, 60 and 10 lb/kilowatt. Included thermionic conversion of 10% efficiency are assumed throughout although one agrees with efficiency up to 17% are (theoretically possible). Anticipated output would be 14 to 25 k.

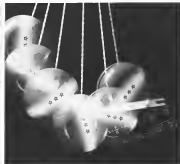
The STAR powerplant replaces the high temperature provided in the reactor system to allow the high power output possible from thermionic conversion at elevated temperatures (1 and temperature in the final powerplant would be 2,600°C, cathode temperature 2,700°C, and reflector surface, 1,600°C).

General Electric plans to use advanced materials, such as tungsten, tantalum, niobium and molybdenum in the powerplant construction. Fuel for the reactor would be uranium oxide-uranium oxide solid solution.

The STAR powerplant is an outgrowth of an extensive program in their centers both here and at other General Electric facilities. This research center's earlier thermionic program includes basic studies in physics, materials, applied converter development and systems efforts.

CAPABILITIES REPORT FROM BENDIX PIONEER-CENTRAL

INERTIA SENSING



INERTIA SENSING EXPERIENCE KEYED TO YOUR NEEDS!

From basic inertia sensing problems to the most sophisticated needs, Bendix—during the past 40 years—has been establishing consistently higher and higher standards in designing and producing inertia sensing devices. From and Ship Industries, Inertial Air Accelerometers, Vertical and Rate Switching Gyros, Rotating Accelerometers, Single and Double Integrating Accelerometers are all part of the evolution that has made Pioneer-Central a leader in this field. There are experi-

ence and capabilities that can meet your inertia sensing needs.

Other areas of outstanding Pioneer-Central capabilities include—Navigation, Precision Sensing Instrumentation, Life Sciences, Fuel Management, and Basic Energy Conversion.

ENGINEERS are invited to investigate the diversified opportunities at Pioneer-Central. All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

PIONEERING IS OUR BUSINESS

Pioneer-Central Division

MINNEAPOLIS, MINN.



West Coast Sales & Service: Bendix Corp., 1000 International Parkway, Suite 200, San Jose, California 95128, U.S.A. Offices: Seattle, Denver, Dallas, Houston, Phoenix, San Francisco, Los Angeles, San Diego, San Jose, Santa Clara, Sunnyvale, and San Francisco.



For the first time, atomic energy is being used in a space vehicle. Signals picked up from the latest Transit navigational satellite have been transmitted successfully by a radioisotope-fueled thermoelectric SNAP[®] generator. This is the beginning. The use of atomic energy—for propulsion as well as auxiliary power—is essential for man to range at will and for extended periods in Space. Atomic energy is the most compact source of power known. The device was designed, developed and built

for the U.S. Atomic Energy Commission by the Nuclear Division of The Martin Company. It provides electricity for instrumentation and for two radio transmitters in Transit, a satellite developed for the U.S. Navy by the Applied Physics Laboratory of Johns Hopkins University. Capable of providing continuous power for many years, the generator's total output will be comparable to that of several thousand pounds of chemical batteries. *"Spacecraft Nuclear Auxiliary Power"*

MARTIN



THEY RELY ON RAOIATION for high-speed X-Y plotting

This X-Y Plotter, designed and built by Radiation for Kirtland AFB, plots five variables graphically against a selectable fifth variable from magnetic tapes generated by digital computer. It also provides identifying notations and text in alpha-numeric characters—at a speed of 90 data points per second.

Radiation engineers achieved a number of technological advances with the Plotter. For example: this highly automated equipment provides quick selection, independent wiring and troubleshooting for each variable. It can reproduce an unlimited number of representative copies of the plot. Advantages of the system are inherent digital accuracy, savings in time and labor, and simplified analysis of experimental data.

The X-Y Plotter illustrates Radiation's ability to design, engineer and build advanced electronic systems for defense and industry. Perhaps you can take advantage of this unusual capability. We'll gladly send more information and a copy of our "Capabilities Report." Radiation Incorporated, Dept. AV-5, Melbourne, Florida.

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.



RADIATION
INCORPORATED

point-by-point procedures which are time consuming to the computer. The new analyzer also is expected to be useful for electronic counter countermeasure applications. For example, a radar operator can use it to determine which frequencies in the spectrum are not being jammed by an enemy in order to know where to shift the radar's operating frequency to avoid jamming.

The new analyzer is available in standard aircraft equipment case for military use or in a commercial-type enclosure. Device measures 100 x 175 x 214 in., weighs 55 lb and draws 175 amp of 115-v., 60 cps power. Price of the unit is \$14,900 f.o.b. Chicago with delivery in 60 days, according to Hils-cobben.

Novel Semiconductor Transducer Devised

Semiconductor strain-gage pressure transducer with a built output which is temperature compensated over the temperature range of -50° to 250°, has been developed by Drexler Division of American Brake Shoe Co., Can-bredy, Mass.

The high output is achieved directly without amplifiers.

The company says it has been able to achieve compensation over the wide temperature range without requiring high output voltage.

Drexler says its new PT-500 pressure transducers are accurate to within 1% of full scale, relative to room temperature static calibration curves. Being able to accept all sources of measurement error—repeatability, nonlinearity, hysteresis and the combined effect of accuracy



high sensitivity pressure transducer, using semiconductor strain gage, has output of 5 volts, gage factor of 100 and is compensated over temperature range of -50° to 250° using new technique.

The Lincoln Laboratory program for ballistic missile range measurements and penetration research includes:

EXPERIMENTAL RESEARCH

Measurements and analysis of ICBM flight phenomena for discrimination and for decoy design purposes, including optical, aerodynamic and RF effects.

SYSTEM ANALYSIS

Studies to apply research findings to advance the technology of ICBM and ACRM systems.

INSTRUMENTATION ENGINEERING

Designing radar, optical and telemetry equipment with which to measure ICBM flight effects under actual range conditions.

RADAR SYSTEMS RESEARCH

Extending the theory and application of radar techniques to problems of discrimination, countermeasures and performance in a dense target environment.

HYPERSONIC AERODYNAMICS

Study of the flow fields around reentering bodies for various body designs and flight conditions. Excellent computer facilities available.

RADAR PHYSICS

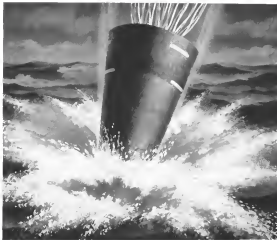
Theoretical and experimental studies in radar back scattering. Interaction of RF radiation with plasmas.

A more complete description of the Laboratory's work will be sent to you upon request.

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.



Research and Development
LINCOLN LABORATORY
Massachusetts Institute of Technology
BOX 25
LEXINGTON 73, MASSACHUSETTS



How the ocean grew "ears" to pinpoint missile shots

A quarter of the world away from its launching pad an experimental missile nose cone splashes into the ocean.

How close has it come to the target?

Where can it be found, recovered and studied?

To answer these questions quickly and accurately, Bell Telephone scientists have developed a special system of deep-sea hydrophones—sensitive "ears" that hear underwater. In essence—the Missile Impact Locating System, or MILS, for short, MILS, produced by Western Electric, manufacturing and supply arm of the Bell System, involves a type of network.

- One is a Long Distance network which monitors millions of square miles of ocean. The nose cone releases a small bomb which sinks and explodes at optimum depth for transmission of underwater sounds. Wherefrom are

picked up by hydrophones stationed at optimum depth and instantly carried by cables to ground stations. Since the vibrations take longer to reach some hydrophones than others, time differences are measured to compute the location of the nose cone.

- The other is a "hot-line" network which monitors a restricted target area. This network is so sensitive that no bomb is needed. It can detect the noise splash of an incoming nose cone and precisely fix its location.

MILS is now operating in both the Atlantic and the Pacific sea ranges. It was installed by the U. S. Navy with technical assistance from Western Electric.

It's still another example of how the universe of sound—below the sea, above the earth, in outer space—is constantly being explored by the Bell Telephone System.

BELL TELEPHONE SYSTEM



AMERICAN TEL. & TEL. CO. / WESTERN ELECTRIC CO. / BELL TELEPHONE LABORATORIES / 21 OPERATING COMPANIES

SPACE TECHNOLOGY

Nimbus Uses Wheels, Jets for Control

By George Alexander

Philadelphia—Polar orbiting Nimbus meteorological satellite, with a sharp gaze, objects of deviating less than one degree in any axis, will use a reaction-wheel and pneumatic control system to maintain its course in a constant earth-orbital orbit.

The attitude-control system, which also must support the instantaneous rate around any axis about 0.5 deg/sec, is being built by General Electric, Missile and Space Vehicle Department, Philadelphia, Pa., for the National Aeronautics and Space Administration's Goddard Space Flight Center and consists of three major assemblies.

- **Three flywheels**, one for each axis, to actively the externally mounted moments of three small 20-lb. reaction wheels.
- **Two reduced moment**, with pneumatic bias as the sensing elements.
- **Two ion beams**, one for course indication and the other to measure gyro accuracy.
- **Eight micropropulsion jets**, two for pitch, two for roll and four for yaw.
- **Small digital computer**, weighing 4 lb. and rated at 5.6 mips. It can detect signals separately by GE for the Nimbus control system.

Control System Sequence

1. Launching of the control system begins. 2. See after separation from the first Agena-B booster and follows this sequence:

One pitch jet, fed from a spherical tank, located directly below the reaction cone of gravity, induces cold nitrogen for 20 sec as an attitude. Most pitchup moment. The 10, 100-msec attitude 100 deg, again along the line of direction, slowly fire and shift of the attitude for the heavens. Seeking a balance in the earth's axis, pitchup jets in each the sensors and small voltage, which are amplified and entered in the computer.

For roll correction, the computer compares the magnitude difference between the trimmers and commands use of the roll jets, mounted atop the longitudinal strap, to rotate a burst of gas. Simultaneously, to correct pitch error, the computer takes only the signal arrived from the forward-looking sensor and activates either one of the pitch jets, also two sensors. By this time, the attitude should be roughly centered, within 1 deg of the desired position along the pitch and



ATTITUDE-CONTROL SYSTEM for Nimbus meteorological satellite forms reaction wheels and compressed gas jets to achieve stabilization within changed design requirements of less than one-degree position deviation and rate of less than .05 deg/sec. (posed eye view. System is being built by General Electric (GE) for NASA's Goddard Center.)

will jets and not rotating faster than .05 deg/sec. If not, the guarantee system has accomplished course orientation and is shut down.

To bring Nimbus within 1 deg. along any axis, the computer now feeds the flywheels through an amplifier to the appropriate flywheel. Each flywheel, 4.7-lb. wheel is spun up to a spin rate of 10,000 rpm and the reaction of the acceleration occurs a torque on the satellite body. Once the spin level has been reached, the input voltage effectively shifts the gyro signal and the satellite wheel stabilizes in the corrected position. In actual operation GE and NASA expect that slight overshoots may occur but that small additional corrections to the wheel will place the satellite right on line.

Each flywheel has a threshold detector, which serves two purposes: initially, it acts as the pneumatic system when the position and rate, once fully beyond the 1 deg., 0.5 deg/sec dead band and thereafter, maintains the tachometer on each wheel. Since the spin rate of the wheels is constant, the detector activates the jets to correct the wheel back to zero spin, when the saturation point of 1,200 rpm has been reached.

At 150 sec, the entire nose sensor—an array of eight solar cells—locks on the sun and gradually brings the nose deviation down to less than 1 deg, again at a rate not to exceed .05 deg/sec. When the error falls below this course level an attitude control transfer system control to a microcomputer gyro which maintains both the yaw and roll rates into a single signal for a torque amplifier. For the next 100 sec, the yaw control feedback is repeatedly spun up and dumped until the Nimbus is within 1 deg, 0.5 deg/sec design parameter.

Stability Achieved

At an altitude after separation, the Nimbus should be stable in all three axes and ready to move on its various commands (ENR Jan. 26, p. 17).

Solar paddles, which will probably drop 8-10 mph, are exposed 2 sec after separation from the booster. A sensor, mounted on the paddle shaft, provides inputs to a drive mechanism which rotates and maintains the paddles perpendicular to the sun's rays. During light periods, the paddles are designed to be sun-oriented to within 10 deg.

The system's fine sun sensor is used to check drift on the sun gear. A

The Bender® E-200 series of lightweight, small size capacitors is designed for installations requiring a high degree of component reliability at operating temperatures as high as 200°C. High temperature capability and macro-film electrical characteristics enable the E-200 series to withstand extremely high orders of AC in small envelope size at all ac voltages under 200°C. The new series is designed and manufactured

E-300 CHARACTERISTICS: • Weave like paper • Solid impregnate • Exceptional stability • High insulation resistance • Bodily resistance • Outstanding dependability

closed box with a very narrow slit on one side and solar cells on the opposite inside wall, the sensor is so located on the control unit that it always catches only when the rays are at right angles to the satellite's local vertical. The resulting output voltage is telemetered.

The festival's six-month cultural life is based on the repair of the compromised indigenous myth. First, each is used throughout the semester, with each festival in solid gold ball-bearing and decorative diamanté.

Power consumption of control system is 75 watt. The 5 J.E. motors have 30 % across the food winding and 0 to 75 % on the control winding.

GE has already built a preprototype and is now testing it at its Philadelphia facility. Prototype model to be sold will consist of units expected to be delivered to Goddard before the end of this year.

Washington—Space-General Corp. has been formed as a subsidiary of Aerojet General Corp. to design and develop missile and space systems, with plans to employ 1,600 scientists and support the increased by next February.

The subsidiary combines Aerojet's Spacecraft Division and the recently acquired Space Electronics Corp. Personnel is Dr. James C. Fletcher, who headed Space Electronics' Frank W. Larkin is executive vice president.

Aerjet will continue work in propulsion, infrared, architectural services, structural glazes and chemicals. Space General will continue its production programs on the Able Star, Aerospace and Aerospace include systems, maintenance for the Ranger, the Douglas deep space telemetry system and terminal modules for ballistic missiles.

Dr. Fletcher said the company is made to bid on the Saturn S-E engine stage and is preparing scotch and scotch umbilicals and a lightweight Prospector spacecraft capable of sampling the lunar surface in a Crater period. The light Prospector, weighing about 300 lb., would be based on the Servicer design.

Amper President Don A. Kaufman said Space-General's biggest volume at the end of the first full fiscal year is expected to be \$10 million. The corporation, which goes into operation with about 700 employees, will be housed in a new plant to be built on a 75-acre site east of Los Angeles on the San Bernardino Freeway.

Washington — Commercial airplane, containing 104 of the Marine Corps' most experienced aviators, was built by AeroVest Inc., a Division of Ford Motor Co for launch by a Blue Streak vehicle in orbit, the military looking ahead.

The experiment, described last month by Veterans Week (AW June 12, p. 31) is scheduled for late summer. Veterans' Aeronautics and Space Administration said that the reconnaissance program will be played as a 700-mile, circular orbit to provide real-time information, operator training and school flight test.

Test will be called **Mission Scout 1** and the satellite will be used as long as the batteries remain active. The communications system is powered by solar-pane batteries and consists of HF and UHF transmitters/receivers, two ground command receivers, two identical transmitters and C- and S-band to the payload beacon.

Scintilla Division



CREATION WITH, July 19, 1941



WIDER RANGE WITH GREATER ACCURACY

This Vought Electronics Servo Analyzer is an all-electronic instrument covering the dynamic range of most servo systems without the troublesome maintenance requirements of mechanical multipliers.

Modulation rates of .005 to 1000 cps in five ranges are provided in sinusoidal, step, and ramp functions either directly or in suppressed carrier form. Modulation frequency accuracy readings of 2% are possible.

Other important unit specifications are:

- carrier frequency range of 50 to 10,000 cps
- carrier phase shift of less than 2° to 5 kc
- signal attenuation of 0 to 99 db in 0.1 db steps
- phase measurement accuracy of 2°

Use of Vought Electronics Servo Analyzer has been demonstrated successfully with Titan and Minuteman missiles as well as in industrial laboratory applications. It is available in both bench and rack mounted models.

For more complete information about this versatile instrument, contact:

Chief of Product Sales
Chance Vought Electronics Division
P. O. Box 1500, Arlington, Texas

CHANCE VUGHT  ELECTRONICS

AVIONICS • AUTOMATIC GUIDANCE • NAVIGATION, ELECTRONICS • GROUND SUPPORT ELECTRONICS

USAF Contracts

Following is list of unclassified contracts for \$25,000 and over as released by U. S. Air Force contracting office:

W. L. BENTLEY, JR., AIRPORTS, INC.
455 E. P. St., Dallas, TX 75201-5111
Natick-Bentley, AFH, 0146

Airline Division General Motors Corp.
Indianapolis Ind. provides systems for
NATC's aircraft monitoring equipment and
test contract AF 33(000)1150 dated
Mar. 9, 1961. \$100,000.

The Goodrich Tire & Rubber Co., Akron,
Ohio, which supplies 75% 300-10-10-10
aircraft tire 41 each, and single construction
75% 140-10-10-10, Akron, Ohio, 41 each.
[75%] General Motors order No. 2 dated
Mar. 28, 1961 to contract AF 33(000)1150
R1, 002.

The Goodrich Tire & Rubber Co., Akron,
Ohio, which supplies 75% 300-10-10-10
aircraft tire 41 each, and single construction
75% 140-10-10-10, Akron, Ohio, 41 each.
[75%] General Motors order No. 2 dated
Mar. 28, 1961 to contract AF 33(000)1150
R1, 002.

A. Ray Brantner's General Electric Co.,
Indianapolis, Ind., provides equipment for
NATC's aircraft monitoring equipment and
test contract AF 33(000)1150 dated
Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

Reflexion Instrument Corp., Highland,
N. Y., provides of 200-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

General Motors Corp., Indianapolis,
Ind., provides of 200-10-10-10-10-10-10-10
equipment for NATC's aircraft monitoring
equipment and test contract AF 33(000)1150
dated Mar. 9, 1961 to contract AF 33(000)1150
R1, 002.

NEW FROM WESTINGHOUSE



ULTRAVIOLET COMMUNICATION SYSTEM FOR SPACE

Westinghouse scientists are developing a new kind of space communication system, called Ultrasonics, it will use a beam of ultraviolet light, modulated to convey information.

In a space vehicle, the electrical supply and volume are limited. Here Ultrasonics will have many advantages over radio. Because UV frequencies are higher than radio—about a million times—signals are distributed free and can be sent farther with less power, 50 million miles, for example, with a modulated power of 1 watt. Ultrasonics will require far less area for antennas, and reliability will be high because of equipment simplicity.

Westinghouse scientists were the first to achieve communications by ultraviolet. Development of the Ultrasonics system for space application is another example of how Westinghouse is Flat with the Future. Defense Products Group, 1000 Connecticut Avenue, N.W., Washington 6, D.C.



Westinghouse

Whispers... from Venus

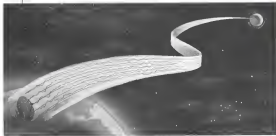
From March 10 to May 10, 1961, JPL's Deep Space Instrumentation Facility at Goldstone, California, conducted an important radar bounce experiment directed at the planet Venus and hundreds of hours of scientific data were collected. The results obtained helped establish the United States as the leader in the new science of planetary radar astronomy.

Prior to this experiment, the Astronomical Unit (AU) contained an uncertainty factor of 80,000 miles which JPL scientists have now been able to reduce

to 1,000 miles—possibly 100 miles—as one of the results of this effort.

Establishing a more accurate value for the AU will enable JPL to measure the exact distance to Venus prior to the launching of the first U.S. Venus probe.

One of the most important conclusions to be drawn from this successful experiment is the knowledge that we can now design a planetary radar observatory capable of almost continuous surveillance of Venus, Mars, Mercury and Jupiter. Therefore, March 10, 1961 marks the beginning of a new era in space technology and exploration.



This scientific accomplishment is only one of the many research programs in progress at JPL under its space exploration responsibility to NASA. These extensive investigations into the science and technology of the space environment offer real and stimulating incentives to ambitious scientists and engineers with searching minds. JPL needs such men, who look forward to rewarding careers in this uncharted field.

Resumes and inquiries directed to A. W. Locke, Manager of Professional Placement, will receive immediate attention.



CALIFORNIA INSTITUTE OF TECHNOLOGY
JET PROPULSION LABORATORY
PASADENA, CALIFORNIA



**EXPERT
IN THE
FIELD**

**FIELD
ENGINEERS**

If you're the kind of engineer who enjoys working with hardware in the field and thrives on tight time schedules, then you'll be interested in a field assignment with General Dynamics' Astronautics.

Positions in field service, base activation, and flight test engineering exist now at Atlas bases and test sites throughout the United States. They require individuals with broad technical ability, sound judgment, and a strong sense of responsibility. In turn, they provide tremendous technical challenge and the satisfaction of being a front-line participant in the free world's greatest deterrent to aggression—the Atlas weapon system.

If you have a degree in engineering and qualify as an expert in the field on all the facts, there's more information on the next page, and you'll find a convenient inquiry card attached. Why not read it today? There's no obligation, of course, and it will be immediately acknowledged. Prompt interviews will be arranged with qualified respondents.

If the inquiry card has been removed, or if you wish to furnish or request more detailed information, please a note to Mr. R. M. Smith, Industrial Relations Administrator-Engineering, Mail Zone 130-90, General Dynamics/Astronautics, 5675 Kraso, Villa Road, San Diego 12, California. If you live in the New York area, please contact Mr. T. Coum, manager of our New York placement office, c/o General Dynamics, 1 Rockefeller Plaza, New York City, telephone Circle 5-5034.)

GENERAL DYNAMICS



ASTRONAUTICS GROUP
FORMERLY COMNAVASTRONAUTICS



Airbus AECOM operational bases and test sites are shown in this map. Operational bases are Fairchild AFB, Spokane, Washington; Western AFB, Cheyenne, Wyoming; Offutt AFB, Omaha, Nebraska; Lincoln AFB, Lincoln, Nebraska; Patrick AFB, Plattsburgh, New York; Schilling AFB, Selma, Kansas; Forbes AFB, Topeka, Kansas; Dyess AFB, Abilene, Texas; Altus AFB, Altus, Oklahoma; Walker AFB, Roswell, New Mexico. Test operations are conducted at Pacific Missile Range, Santa Maria, California; Muroc, California; Sycamore Canyon, San Diego, California; Atlantic Missile Range, Cape Canaveral, Florida.

FIELD SERVICE ENGINEERS

These assignments involve technical representation to the Air Force at various operational AECOM bases. Minimum requirements are a B.S. in engineering, plus field service, flight test or test engineering experience.

BASE ACTIVATION ENGINEERS

Design or liaison engineers with a B.S. in M.E. or E.E., plus experience in electrical or mechanical systems. Work involves liaison or design support on launch control equipment, propulsion systems, automatic programming and missile checkout equipment operations.

FLIGHT TEST ENGINEERS

This work involves determination of test requirements and configuration, readying vehicle for launch operations, analysis of flight test data, and systems performance analysis. ADS in A.E., M.E. or E.E. test experience in testing and instrumentation required.

TECHNICAL OPENINGS ALSO EXIST IN OTHER SPECIALTIES

Write to Mr. M. Smith, Technical Relations Administrative Engineering, Mail Zone 150-10 General Dynamics/Astronautics, 1675 Kearny Villa Road, San Diego 12, California. If you live in the New York area, please contact Mr. T. Conner, manager of our New York placement office, c/o General Dynamics, 1 Rockefeller Plaza, New York City, telephone (Circle 5-1014).

EO 12812, 12813, 12814, 12815, 12816, 12817, 12818, 12819, 12820, 12821, 12822, 12823, 12824, 12825, 12826, 12827, 12828, 12829, 12830, 12831, 12832, 12833, 12834, 12835, 12836, 12837, 12838, 12839, 12840, 12841, 12842, 12843, 12844, 12845, 12846, 12847, 12848, 12849, 12850, 12851, 12852, 12853, 12854, 12855, 12856, 12857, 12858, 12859, 12860, 12861, 12862, 12863, 12864, 12865, 12866, 12867, 12868, 12869, 12870, 12871, 12872, 12873, 12874, 12875, 12876, 12877, 12878, 12879, 12880, 12881, 12882, 12883, 12884, 12885, 12886, 12887, 12888, 12889, 12890, 12891, 12892, 12893, 12894, 12895, 12896, 12897, 12898, 12899, 12900, 12901, 12902, 12903, 12904, 12905, 12906, 12907, 12908, 12909, 12910, 12911, 12912, 12913, 12914, 12915, 12916, 12917, 12918, 12919, 12920, 12921, 12922, 12923, 12924, 12925, 12926, 12927, 12928, 12929, 12930, 12931, 12932, 12933, 12934, 12935, 12936, 12937, 12938, 12939, 12940, 12941, 12942, 12943, 12944, 12945, 12946, 12947, 12948, 12949, 12950, 12951, 12952, 12953, 12954, 12955, 12956, 12957, 12958, 12959, 12960, 12961, 12962, 12963, 12964, 12965, 12966, 12967, 12968, 12969, 12970, 12971, 12972, 12973, 12974, 12975, 12976, 12977, 12978, 12979, 12980, 12981, 12982, 12983, 12984, 12985, 12986, 12987, 12988, 12989, 12990, 12991, 12992, 12993, 12994, 12995, 12996, 12997, 12998, 12999, 13000, 13001, 13002, 13003, 13004, 13005, 13006, 13007, 13008, 13009, 13010, 13011, 13012, 13013, 13014, 13015, 13016, 13017, 13018, 13019, 13020, 13021, 13022, 13023, 13024, 13025, 13026, 13027, 13028, 13029, 13030, 13031, 13032, 13033, 13034, 13035, 13036, 13037, 13038, 13039, 13040, 13041, 13042, 13043, 13044, 13045, 13046, 13047, 13048, 13049, 13050, 13051, 13052, 13053, 13054, 13055, 13056, 13057, 13058, 13059, 13060, 13061, 13062, 13063, 13064, 13065, 13066, 13067, 13068, 13069, 13070, 13071, 13072, 13073, 13074, 13075, 13076, 13077, 13078, 13079, 13080, 13081, 13082, 13083, 13084, 13085, 13086, 13087, 13088, 13089, 13090, 13091, 13092, 13093, 13094, 13095, 13096, 13097, 13098, 13099, 13100, 13101, 13102, 13103, 13104, 13105, 13106, 13107, 13108, 13109, 13110, 13111, 13112, 13113, 13114, 13115, 13116, 13117, 13118, 13119, 13120, 13121, 13122, 13123, 13124, 13125, 13126, 13127, 13128, 13129, 13130, 13131, 13132, 13133, 13134, 13135, 13136, 13137, 13138, 13139, 13140, 13141, 13142, 13143, 13144, 13145, 13146, 13147, 13148, 13149, 13150, 13151, 13152, 13153, 13154, 13155, 13156, 13157, 13158, 13159, 13160, 13161, 13162, 13163, 13164, 13165, 13166, 13167, 13168, 13169, 13170, 13171, 13172, 13173, 13174, 13175, 13176, 13177, 13178, 13179, 13180, 13181, 13182, 13183, 13184, 13185, 13186, 13187, 13188, 13189, 13190, 13191, 13192, 13193, 13194, 13195, 13196, 13197, 13198, 13199, 13200, 13201, 13202, 13203, 13204, 13205, 13206, 13207, 13208, 13209, 13210, 13211, 13212, 13213, 13214, 13215, 13216, 13217, 13218, 13219, 13220, 13221, 13222, 13223, 13224, 13225, 13226, 13227, 13228, 13229, 13230, 13231, 13232, 13233, 13234, 13235, 13236, 13237, 13238, 13239, 13240, 13241, 13242, 13243, 13244, 13245, 13246, 13247, 13248, 13249, 13250, 13251, 13252, 13253, 13254, 13255, 13256, 13257, 13258, 13259, 13260, 13261, 13262, 13263, 13264, 13265, 13266, 13267, 13268, 13269, 13270, 13271, 13272, 13273, 13274, 13275, 13276, 13277, 13278, 13279, 13280, 13281, 13282, 13283, 13284, 13285, 13286, 13287, 13288, 13289, 13290, 13291, 13292, 13293, 13294, 13295, 13296, 13297, 13298, 13299, 13300, 13301, 13302, 13303, 13304, 13305, 13306, 13307, 13308, 13309, 13310, 13311, 13312, 13313, 13314, 13315, 13316, 13317, 13318, 13319, 13320, 13321, 13322, 13323, 13324, 13325, 13326, 13327, 13328, 13329, 13330, 13331, 13332, 13333, 13334, 13335, 13336, 13337, 13338, 13339, 13340, 13341, 13342, 13343, 13344, 13345, 13346, 13347, 13348, 13349, 13350, 13351, 13352, 13353, 13354, 13355, 13356, 13357, 13358, 13359, 13360, 13361, 13362, 13363, 13364, 13365, 13366, 13367, 13368, 13369, 13370, 13371, 13372, 13373, 13374, 13375, 13376, 13377, 13378, 13379, 13380, 13381, 13382, 13383, 13384, 13385, 13386, 13387, 13388, 13389, 13390, 13391, 13392, 13393, 13394, 13395, 13396, 13397, 13398, 13399, 13400, 13401, 13402, 13403, 13404, 13405, 13406, 13407, 13408, 13409, 13410, 13411, 13412, 13413, 13414, 13415, 13416, 13417, 13418, 13419, 13420, 13421, 13422, 13423, 13424, 13425, 13426, 13427, 13428, 13429, 13430, 13431, 13432, 13433, 13434, 13435, 13436, 13437, 13438, 13439, 13440, 13441, 13442, 13443, 13444, 13445, 13446, 13447, 13448, 13449, 13450, 13451, 13452, 13453, 13454, 13455, 13456, 13457, 13458, 13459, 13460, 13461, 13462, 13463, 13464, 13465, 13466, 13467, 13468, 13469, 13470, 13471, 13472, 13473, 13474, 13475, 13476, 13477, 13478, 13479, 13480, 13481, 13482, 13483, 13484, 13485, 13486, 13487, 13488, 13489, 13490, 13491, 13492, 13493, 13494, 13495, 13496, 13497, 13498, 13499, 13500, 13501, 13502, 13503, 13504, 13505, 13506, 13507, 13508, 13509, 13510, 13511, 13512, 13513, 13514, 13515, 13516, 13517, 13518, 13519, 13520, 13521, 13522, 13523, 13524, 13525, 13526, 13527, 13528, 13529, 13530, 13531, 13532, 13533, 13534, 13535, 13536, 13537, 13538, 13539, 13540, 13541, 13542, 13543, 13544, 13545, 13546, 13547, 13548, 13549, 13550, 13551, 13552, 13553, 13554, 13555, 13556, 13557, 13558, 13559, 13560, 13561, 13562, 13563, 13564, 13565, 13566, 13567, 13568, 13569, 13570, 13571, 13572, 13573, 13574, 13575, 13576, 13577, 13578, 13579, 13580, 13581, 13582, 13583, 13584, 13585, 13586, 13587, 13588, 13589, 13590, 13591, 13592, 13593, 13594, 13595, 13596, 13597, 13598, 13599, 13600, 13601, 13602, 13603, 13604, 13605, 13606, 13607, 13608, 13609, 13610, 13611, 13612, 13613, 13614, 13615, 13616, 13617, 13618, 13619, 13620, 13621, 13622, 13623, 13624, 13625, 13626, 13627, 13628, 13629, 13630, 13631, 13632, 13633, 13634, 13635, 13636, 13637, 13638, 13639, 13640, 13641, 13642, 13643, 13644, 13645, 13646, 13647, 13648, 13649, 13650, 13651, 13652, 13653, 13654, 13655, 13656, 13657, 13658, 13659, 13660, 13661, 13662, 13663, 13664, 13665, 13666, 13667, 13668, 13669, 13670, 13671, 13672, 13673, 13674, 13675, 13676, 13677, 13678, 13679, 13680, 13681, 13682, 13683, 13684, 13685, 13686, 13687, 13688, 13689, 13690, 13691, 13692, 13693, 13694, 13695, 13696, 13697, 13698, 13699, 13700, 13701, 13702, 13703, 13704, 13705, 13706, 13707, 13708, 13709, 13710, 13711, 13712, 13713, 13714, 13715, 13716, 13717, 13718, 13719, 13720, 13721, 13722, 13723, 13724, 13725, 13726, 13727, 13728, 13729, 13730, 13731, 13732, 13733, 13734, 13735, 13736, 13737, 13738, 13739, 13740, 13741, 13742, 13743, 13744, 13745, 13746, 13747, 13748, 13749, 13750, 13751, 13752, 13753, 13754, 13755, 13756, 13757, 13758, 13759, 13760, 13761, 13762, 13763, 13764, 13765, 13766, 13767, 13768, 13769, 13770, 13771, 13772, 13773, 13774, 13775, 13776, 13777, 13778, 13779, 13780, 13781, 13782, 13783, 13784, 13785, 13786, 13787, 13788, 13789, 13790, 13791, 13792, 13793, 13794, 13795, 13796, 13797, 13798, 13799, 13800, 13801, 13802, 13803, 13804, 13805, 13806, 13807, 13808, 13809, 13810, 13811, 13812, 13813, 13814, 13815, 13816, 13817, 13818, 13819, 13820, 13821, 13822, 13823, 13824, 13825, 13826, 13827, 13828, 13829, 13830, 13831, 13832, 13833, 13834, 13835, 13836, 13837, 13838, 13839, 13840, 13841, 13842, 13843, 13844, 13845, 13846, 13847, 13848, 13849, 13850, 13851, 13852, 13853, 13854, 13855, 13856, 13857, 13858, 13859, 13860, 13861, 13862, 13863, 13864, 13865, 13866, 13867, 13868, 13869, 13870, 13871, 13872, 13873, 13874, 13875, 13876, 13877, 13878, 13879, 13880, 13881, 13882, 13883, 13884, 13885, 13886, 13887, 13888, 13889, 13890, 13891, 13892, 13893, 13894, 13895, 13896, 13897, 13898, 13899, 13900, 13901, 13902, 13903, 13904, 13905, 13906, 13907, 13908, 13909, 13910, 13911, 13912, 13913, 13914, 13915, 13916, 13917, 13918, 13919, 13920, 13921, 13922, 13923, 13924, 13925, 13926, 13927, 13928, 13929, 13930, 13931, 13932, 13933, 13934, 13935, 13936, 13937, 13938, 13939, 13940, 13941, 13942, 13943, 13944, 13945, 13946, 13947, 13948, 13949, 13950, 13951, 13952, 13953, 13954, 13955, 13956, 13957, 13958, 13959, 13960, 13961, 13962, 13963, 13964, 13965, 13966, 13967, 13968, 13969, 13970, 13971, 13972, 13973, 13974, 13975, 13976, 13977, 13978, 13979, 13980, 13981, 13982, 13983, 13984, 13985, 13986, 13987, 13988, 13989, 13990, 13991, 13992, 13993, 13994, 13995, 13996, 13997, 13998, 13999, 14000, 14001, 14002, 14003, 14004, 14005, 14006, 14007, 14008, 14009, 14010, 14011, 14012, 14013, 14014, 14015, 14016, 14017, 14018, 14019, 14020, 14021, 14022, 14023, 14024, 14025, 14026, 14027, 14028, 14029, 14030, 14031, 14032, 14033, 14034, 14035, 14036, 14037, 14038, 14039, 14040, 14041, 14042, 14043, 14044, 14045, 14046, 14047, 14048, 14049, 14050, 14051, 14052, 14053, 14054, 14055, 14056, 14057, 14058, 14059, 14060, 14061, 14062, 14063, 14064, 14065, 14066, 14067, 14068, 14069, 14070, 14071, 14072, 14073, 14074, 14075, 14076, 14077, 14078, 14079, 14080, 14081, 14082, 14083, 14084, 14085, 14086, 14087, 14088, 14089, 14090, 14091, 14092, 14093, 14094, 14095, 14096, 14097, 14098, 14099, 14100, 14101, 14102, 14103, 14104, 14105, 14106, 14107, 14108, 14109, 14110, 14111, 14112, 14113, 14114, 14115, 14116, 14117, 14118, 14119, 14120, 14121, 14122, 14123, 14124, 14125, 14126, 14127, 14128, 14129, 14130, 14131, 14132, 14133, 14134, 14135, 14136, 14137, 14138, 14139, 14140, 14141, 14142, 14143, 14144, 14145, 14146, 14147, 14148, 14149, 14150, 14151, 14152, 14153, 14154, 14155, 14156, 14157, 14158, 14159, 14160, 14161, 14162, 14163, 14164, 14165, 14166, 14167, 14168, 14169, 14170, 14171, 14172, 14173, 14174, 14175, 14176, 14177, 14178, 14179, 14180, 14181, 14182, 14183, 14184, 14185, 14186, 14187, 14188, 14189, 14190, 14191, 14192, 14193, 14194, 14195, 14196, 14197, 14198, 14199, 14200, 14201, 14202, 14203, 14204, 14205, 14206, 14207, 14208, 14209, 14210, 14211, 14212, 14213, 14214, 14215, 14216, 14217, 14218, 14219, 14220, 14221, 14222, 14223, 14224, 14225, 14226, 14227, 14228, 14229, 14230, 14231, 14232, 14233, 14234, 14235, 14236, 14237, 14238, 14239, 14240, 14241, 14242, 14243, 14244, 14245, 14246, 14247, 14248, 14249, 14250, 14251, 14252, 14253, 14254, 14255, 14256, 14257, 14258, 14259, 14260, 14261, 14262, 14263, 14264, 14265, 14266, 14267, 14268, 14269, 14270, 14271, 14272, 14273, 14274, 14275, 14276, 14277, 14278, 14279, 14280, 14281, 14282, 14283, 14284, 14285, 14286, 14287, 14288, 14289, 14290, 14291, 14292, 14293, 14294, 14295, 14296, 14297, 14298, 14299, 14300, 14301, 14302, 14303, 14304, 14305, 14306, 14307, 14308, 14309, 14310, 14311, 14312, 14313, 14314, 14315, 14316, 14317, 14318, 14319, 14320, 14321, 14322, 14323, 14324, 14325, 14326, 14327, 14328, 14329, 14330, 14331, 14332, 14333, 14334, 14335, 14336, 14337, 14338, 14339, 14340, 14341, 14342, 14343, 14344, 14345, 14346, 14347, 14348, 14349, 14350, 14351, 14352, 14353, 14354, 14355, 14356, 14357, 14358, 14359, 14360, 14361, 14362, 14363, 14364, 14365, 14366, 14367, 14368, 14369, 14370, 14371, 14372, 14373, 14374, 14375, 14376, 14377, 14378, 14379, 14380, 14381, 14382, 14383, 14384, 14385, 14386, 14387, 14388, 14389, 14390, 14391, 14392, 14393, 14394, 14395, 14396, 14397, 14398, 14399, 14400, 14401, 14402, 14403, 14404, 14405, 14406, 14407, 14408, 14409, 14410, 14411, 14412, 14413, 14414, 14415, 14416, 14417, 14418, 14419, 14420, 14421, 14422, 14423, 14424, 14425, 14426, 14427, 14428, 14429, 14430, 14431, 14432, 14433, 14434, 14435, 14436, 14437, 14438, 14439, 14440, 14441, 14442, 14443, 14444,



Target in 14 countries

The target is a Northrop drone. The countries using it are Belgium, Canada, Denmark, Great Britain, Iraq, Italy, Japan, Nationalist China, Netherlands, Portugal, Republic of Korea, Spain, Sweden, and West Germany. Northrop target drones and missiles, surveillance drones, and complete support systems are built by

RADIOPLANE
A DIVISION OF
NORTHROP

New Offerings

Vienna Associates, Palo Alto, Calif., the company and its subsidiaries are engaged in the design, manufacture and sale of aerospace tubes, electronic instruments, various equipment and electronic systems and components for military, commercial and industrial use. Offering is \$47,851 shares of capital stock, for subscription by shareholders at the rate of one new share for each 10 shares held, second class subscription price and underwriting terms to be supplied by memorandum. Of the proceeds the company proposes to utilize approximately \$3,570,000 for construction of two new buildings at its principal plant at Palo Alto and for a new plant in Lexington, Ky. \$7,100,000 will be expended during the balance of 1961 and \$4,900,000 during 1962 for additional equipment acquired, for expansion of the company's productive capacity. \$4,500,000 will be allocated for acquisition and development of an additional plant site; an unexpended amount of bank borrowings will be retired, and the balance added to working capital.

Advanced Scientific Instruments, Inc., Minneapolis, Minn., organized under Minnesota law on March 1961, the company proposes to engage in the business of developing, manufacturing, selling and leasing electronic, electro-mechanical and electro-optical equipment for use in the general categories of scientific calculation, instrumentation and process control, data handling and processing, data recording, data communication, data conversion and guidance and navigation. Offering is 875,000 shares of common stock, for public sale at \$1.15 per share. Of the proceeds (plus \$112,000 proceeds from the sale of 117,000 common shares to the promoters) \$100,000 will be used for equipment installation costs and leasehold improvements and 80% of the balance for development work during the first year of operations and 60% for general working capital including material, direct labor and overhead.

Anker Corp., Boston, Mass., engaged in the design, development and manufacture of high speed pointers and high speed paper tape readers for use in association with computers and electronic data processing equipment or systems. It is also engaged in research, development and manufacture of other electronic and electro-mechanical systems and equipment. A subsidiary is engaged in producing technical literature and manuals for industry and government agencies. Offering is 12,354 outstanding shares of common stock,

CLEANING Specialists FOR AMERICAN INDUSTRY

DETREX CHEMICAL INDUSTRIES, INC.

1000 LA CROIX BL. TROY, N.Y. 12180
DETROIT'S SUBSIDIARY PLANT

FULL-FLEDGED PARTNERS IN AMERICA'S VITAL AEROSPACE PROGRAM

Detrex know-how and superbly designed products are being supplied to the Aerospace Industry in constantly increasing amounts.

Historically every major industry in the country has benefited from the marked superiority of Detrex chemicals, equipment and service.

Here is a combination of facilities and services unequalled in its field.

There is only one Detrex—a single, quality source for all your metal cleaning requirements.

Write today for detailed information on our products or services.

Perm-A-Gel (H) (hydrochloric)

Solvent Degreasers

Ultrasonic Equipment

Aluminum Treating Compounds

Alkali and Emulsion Cleaners

Best Finishing Materials

Super Cleaners

Phosphate Coating Compounds

Pretreatment Compounds

Etchant and Cleaning Compounds

Spray Bench Compounds

Inhibits in Washes

CHEMICAL INDUSTRIES, INC.

1000 3RD, 6TH, 8TH AVE., DETROIT 22, MICH.

Airborne DC Amplifier



Small, solid state, direct-coupled DC amplifier weighs only six ounces. Less than five cubic inches in volume, this rugged, hermetically sealed instrument is available with solder, plug-in, or on-board carrier arrangements and a variety of mountings. DC gain is 200 to 1000 $\pm 0.75\%$. Input impedance is 5 megohms differential at maximum gain; output capability is ± 5 volts into load less than 10K (single-ended). Microdot Inc., 220 Pasadena Avenue, South Pasadena, California.

Temperature Transducer



Small probe-type device for high and low temperature applications where high accuracy and severe flow conditions are imposed. Precision liquid or gaseous measurements to 800°F. Very sensing element is deposited platinum film allows high base accuracy, extreme linearity, wide range capability, and fast response. Approved for ICRM environments.

Microdot Inc., 220 Pasadena Avenue, South Pasadena, California.

VHF-UHF TRANSMITTERS



Proved in history's most demanding environmental laboratory—outer space—the custom designed unit shown above is typical of the development skill and production capability available from Microdot. The unit shown is miniatured, guaranteed, and features a solid state power supply that cannot be damaged by input/output overloads. Units are available in a complete range of modulation—CW, FM, Phase, and Pulse, with frequency coverage 180 to 8000 mc/s and output from 100 mw to 10 watts.

Telemetry Capabilities of Microdot have been dramatically expanded with the recent acquisition of Spectral's Instrument Company. The highly talented development skill, production capability, and working experience of Spectral's in the field of vhf and uhf systems and related instrumentation is available from Microdot's Instrumentation Division. This equipment, outstanding in its attention to miniaturization and ruggedness, is a vital part of such important projects as Pioneer X, Jupiter, Atlas, Pershing, Redstone and Echo I.

UHF Telemetry Transmitters, Model's 2406 and 2405, use a unique automatically stabilized circuit, with the output frequency referenced directly to a quartz crystal. This approach allows a greatly reduced size compared to the multiplier chain one would normally require to achieve crystal stability, as well as increased reliability due to a fewer number of parts.

The transmitter has three own solid state power supply designed to provide a high ratio of output power to turn power cost. The frequency modulation circuitry is sufficiently robust to introduce completely negligible distortion to the modulation signal. For further information, call Microdot or write for catalog sheet (T-1).

OPERATIONS

Frequency Range	120-1200 mc/s
Model 2406	1435-2535 mc/s
Frequency Stability	3.00%
Power Output	10 watts
Power Input	
Modulation	1 db
Modulation	FM/AM/PM/SSB/LS
Voice Voltage	35 vdc
Compressor Ratio	40:1 to 20:1
Ant. Imp.	15 ± 5 ohms
Size	1 7/8" x 1 1/2"
Weight	12 pounds

MICRODOT INC.

220 Pasadena Avenue, South Pasadena, Calif.
 Microdot 8-3381 • Telex 9-9171



for public sale from time to time by the holders thereof on the over-the-counter market at prices related to the current market prices at the time of sale. Offering also includes 130,000 common shares, owned by one of the selling shareholders, which are subject to purchase by three persons to whom shares have been granted by purchase at \$7.10 per share; 54,000 common shares previously registered with the SEC and which underlie warrants which were attached to an issue of debentures previously sold, which warrants are exercisable after January, 1961, at from \$16 to \$17.50 per share. Proceeds from the exercise of the warrants will be added to the company's working capital.

Hitherto Instruments, Inc., Denver, Colo., engaged in the design, manufacture and sale of electronic recording instruments for the electronic industry, electronic measuring and testing instruments for commercial and military use, and electronic assemblies used in various phases of missile testing. Through wholly owned subsidiaries, the company is also engaged in the design, manufacture and sale of various, heavier electronic devices, printed circuits, electronic antennas, lightning arresters, and electronic chemical microfilm industrial electronic system and electronic gun assemblies, electronic and electronic heating devices, gas analysis and electronic equipment used in the control systems of air aircraft and missiles. Offering is 151,200 shares of common stock of this stock, an unregistered offering (up to 90,000 shares) is to be offered for public sale by the present holders thereof.

Secor Capital Corp., Philadelphia, Pa., acquired under Pennsylvania law in March, 1961, the company is a small business investment company (as registered by the Securities and Exchange Commission under the Securities Act of 1933) and registered in a classified non-exempted management investment company under the Investment Company Act of 1940. Review will consist of reviewing capital, through the purchase of equity and debt securities, in selected well known business concerns engaged principally in the field of applied science and modern technology making long-term loans to such concerns, providing advisory and management consulting services and rendering specialized financial, administrative and technical assistance to such concerns in which the company has or will invest. Offering is 450,000 shares of common stock for public sale at \$5 per share offering to be made on an all or none basis. Proceeds will be used to provide investment capital and management services.

TAPE TAPER



NEW EECO HIGH-SPEED MAG TAPE REWIND UNIT 1690, 6 WEEKS DELIVERY

Tame your tape rewind problems at the industry's lowest cost for all these features: Fast automatic stop when tape ends or power fails. Rewinds 104" reel in 75 seconds. Constant tension for unusually even winding. Tension selector. Universal hub accepts NAB, UNTVAC or IBM reels. Precision guides handle 3/8", 1/2" or 1" tape without adapters. Unit takes reels up to 14" diameter. Operation on 110v ac, 60 cps, 150 vs. Serial availability 6 weeks. Send for Data File TR-389.

EXCLUSIVE REGION



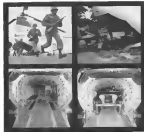
Electronic Engineering Company of California
 150 E. Chestnut Ave. • Santa Ana, Calif. • Electronic Sales • TWX 5-8344-000

THE
WORLD'S
ONLY

"MISSION MODULE" HELICOPTER

"Mission module" design of the new, twin-turbine-powered, Boeing-Vertol 107 means this truly versatile helicopter can perform a wide range of military assignments—without costly or time-consuming conversion. A change from cargo mission to mine-sweeping can be made readily because of basic aircraft design.

The Boeing Vertol 107's capability to perform many missions early on, made it the logical choice for India's flexible and alert Armed Forces.



VERTOL DIVISION **BOEING**
MOBILE, ALA. PENNSYLVANIA

SAFETY

Nacelle Oscillation Led to Electra Crash

The flight plan, prepared by the crew and filed with company operations, indicated a flight from Midway Airport, near Venice area 52 to Portage, Pleasant, Venice 171 to Seaside, Indiana, Venice 249 to Chorro, scope Venetian Venice 710 to Adkins, Georgia, Venice 727 to Albany, Georgia, Venice 730 to Cary, Georgia, Venice 7 to Fort Myers, Florida, Venice 35 to Miami, Florida, a cruising altitude of 18,000 feet, a true speed of 317 knots, and an

Northwest Airlines Flight 710 of March 17, 1968, a Lockheed L400 aircraft N. 121 US, was scheduled between Minneapolis, Minnesota, and Miami, Florida, with an

the diversion of the synaptic neurons, a result of the on route and eventual loss of the members of the crew and pilot squads. The malfunctioning and their subsequent deaths were, according to Florida State University, the result of the lack of air stress on the participants that the little because it appeared to be growing as slowly. No mention was made however of any data on turbulence being present along the route.

The light departed Minneapolis at 12:57 and arrived at Midway at 1:15; the trip to Chicago was routine. It should be noted that none of the witnesses saw the light.

At Chicago only very hard others said that it was a natural finding in every report.

During this short time the search was on the ground at Chicago, apparently. It was not, it was referred and prepared for

Swedish systems meant to the north. It posted a letter to prevent cloud data from the Chicago area to Victor Shale, Indiana, with an average time estimate of 1,000 feet above the ground. Above this cloud data was a second cloud layer which was better to prevent with at least at approximately \$200 per foot. This mean low estimated cost

Considering apples and reports available from ground-based observations as well as pilot reports, the following data has been extracted relative to the magnitude of horizontal and vertical shear as well as wind shift across the troughline (along the IJense-Jokums border):

Vertical Shear
Number/In. 10-800.15,000 (see=10) lbs /
1,000 lbs.

At 15,000 feet, 38 degrees between Fresno and Dayton
 46 degrees between Fresno and North

18 *Agnes between Pavia and Nubia*
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850

Vertical Stem
Nucleoli: 16,000-17,000 Area: 25 LxW
1,000 feet

At 10:00 Sun, 60 degrees between
Punta and Capton.

At 10,000 feet, 18 degrees between
Focus and Dayton
46 degrees between Focus and Nash

* 1500 c. s. t., 10 miles south Dayton, road
exit to open clear air embankment 20,000
feet—600 feet thick—P-101

- 1480 c.s. 1, Germany moderate to heavy influence 20,000 to 15,000 feet T-31
- 1480 c.s. 1, New Hope Kentucky cherry

at 21 000, to 15 degrees centrifuge rotation, was done at edge of jet stream. Disturbed and cleared prior airport facilities and

• 1914 p. 1, Columbia, Ohio, to York, Kentucky, modern in some substance

• 1904: a. t. Luskville to Cincinnati, and
east side of the river to 17,000 to 25,000
feet. 17

• 1912 e. s. t., 10 miles north Louisville, Mo.





more than just talk!

Magnavox continues to maintain a position of leadership in the airborne communications field.

Magnavox engineering, in conjunction with the Air Force, has developed an advanced airborne communications system that is designed to meet the requirements of the future. Utilizing wide band techniques, such functions as television relay for bomb damage assessment, data link for control and identification, and many other forms of air-to-air and air-to-ground communications can all be realized over the same equipment as used for voice.

Magnavox

AN/ARC-50 SYSTEM



THE MAGNAVOX CO. • DEPT. 413 • Government and Industrial Divisions • FORT WAYNE, IND.

in nonstructural shear metal construction.

The left wing reinforcement disclosed that from an irregular fracture line, roughly parallel to station 101, extending to the fuselage the left wing structure, skins and ribs remained attached to the fuselage and a crack the spread. The portion of the left wing and skin on the fuselage remained attached and separated from the airplane at right. Shear of the fracture in the right end of the wing has areas disclosed that they would have remained fixed portions of the upper and lower covers and the fast and not just away from the main structure, damage was limited. Similarly, the wing had portions pulled the side up to at wing station 101 at the ends of the wing. This is the structural backbone of the carbon fiber skin, which extends a hood to wing station 121 with no other assembly fasteners or bolters other than the side rib ribs at 11 to 13 inch spacing. Failure and separation of the main and the skin skin would have severed load as a consequence of the wing has action disintegrating.

Severe bolt shear damage was found at the outer end of the right wing, from station 78. There a large segment of the upper cover was forced upward off the inner rib ribs and separated from the wing as a whole. In all, about the side end at station 101 and the outer end of the front spar were bolted upward and pulled upward from each other. The damage to the outer ribs of both the right and left wing has serious structural side side structural portions generated by the in the partially solid one-bolted ribs running into the outer end as a result of high inertial acceleration as occurred with failure of the right wing at the root. Overpenetration of the carbon fiber skin including a hole had caused point damage each failure shown.

DAMAGE STUDY

Study of the damage to the right wing shown on the fuselage, and the ribbed wing disclosed a fracture in the right spar at wing station 73 and on in the rear spar at wing station 101. There were the ribbed ends of the two sections which remained with the separated right wing. The upper and lower wing covers and ribs between the spars in this area were detached and were pieces in the ground separately and were pieces in the ground separately. The bonded leading edge between the fuselage and the right in fuselage also led to the ground separately in a number of places.

The bonded leading edge separated from the wing by the upper skin pulling off the rear fuselage in a generally forward direction at the attachment in the forward direction ribs attached to the upper rib of the front spar. After the failure the leading edge, which was in the line of front of the plane have which extends to the lower tip of the front spar and the top tip of the plane have disclosed in bonding. The cut ribs of the bonded leading edge were damaged to underload with the ribs of the adjacent bond leading edge sections. Some of this damage was around some area from station 101 to station 121, but was broken apart. Superimposed on this was vertical and in the direction from above to below, up and down movement of the bonded upper and lower covers and ribs separated and from above to below up and

down separate leading dislocation.

Prior to separation of the bonded leading edge, from the wing, as indicated by sharp discontinuities in the direction of the leading edge upper skin portion off the back of the main in the rear pulling the upper spar up a section of the right wing and the upper wing had up large bond up, extending from the station 101 of the rear spar with internal portions of the rib ribs from station 73 and 97. It was found that the upper ribs of the front spar were bonded and not as a sharp discontinuity after the above separation. Some separation of the front spar was a bonded feature at the front spar, which provided a horizontal line not extending outward from station 73 to the rear spar ribs, at station 101 in a bonded leading. Thus all of the rear spar ribs from the vertical ribs of the rear spar prepared, covered considerable distance from the rear spar.

The upper and lower covers of the front wing consist of large 7178 and 7075 aluminum alloy extruded shapes fastened to form a strong, cohesive integral with the skin. The low energy absorption and yield of these materials prior to failure results in the failure irregularly taking in portions of the leads, producing shear and of failure propagation. However, the fact that the upper ribs are bonded together between ribs in the front spar from the front spar at station 51 to the rib edge of pluck 4 at station 115 and from the rib edge of pluck 5 at station 119 to the rear spar at station 97, indicates severe stresses of loading during the loading.

Laboratory examination of the fracture also disclosed some indication of both tension and compression due to alternate upward and downward loading of the wing, combined with compressing, resulting in shear due to tension. Right section loading of two large separated pieces of the lower cover in this area in contact with points were not due to low energy loading in a time when the ribs at station 51 111 and 119 were providing little or no lateral restraint.

The fracture of the right wing upper cover between the fuselage and the ribbed rib had three characteristics of local compression buckling. The upper skin between station 51 and 111 and some characteristics of the wing being about a downward bow through the upper surface between station 111 and 101 with the structural integrity of the front spar and lower cover was destroyed. Downward at the rear spar at and adjacent to station 101 the upper cover. Further compression cooperation with the rear spar being apart that from the control rib and leading upper.

Reconstruction and study of the right wing ribs at station 83, 101, 111, 117, 141 and 115 disclosed no evidence of any failure in the damaged ribs, partly due to the lack of sufficient evidence to make a positive determination of the exact manner in which most of the damage had been done. From a view a few points, evidence of failure, consistent with evidence forward bond.

Several of the rib disposal failure were quite similar in appearance to corresponding ribs found in an American Airlines 130th

Barber-Colman temperature controls chosen by leading makers of ground support equipment



Today's air and space vehicles call for a growing array of ground support equipment. Shown above are a few examples of support units employing Barber-Colman temperature control systems. Components used include: control boxes, solenoids, valves, temperature sensing elements, and thermostats. The systems are specifically engineered for each application through the teamwork of the ground control manufacturer and Barber-Colman.

THE BARRER-COLMAN SYSTEM

TYPICAL FUNCTIONS OF BARBER-COLMAN SYSTEMS

Controlling temperature of aircraft on ground, in-flight, and in storage.

Controlling temperature of aircraft on ground, in-flight, and in storage.

Controlling temperature of aircraft on ground, in-flight, and in storage.

Barber-Colman has a wide range of products for ground support equipment. For more information, contact your nearest Barber-Colman representative.

Barber-Colman Company
1000 North 10th Street, Suite 100
Fort Wayne, Indiana 46802

KNOW YOUR ALLOT STEELS...

Taking one of a series of advertisements dealing with issues from about 1960 to 1980. Though much of the information is elementary, we believe it will be of interest to many who study kind of work to remove fundamental from time to time.



zur Übung:
Chemie
Verstärker

Flame-Hardening Alloy Steels

The process known as flame-hardening involves the direct application of flame to the surface of steel, heating it above the transformation range, then hardening it by quenching. The primary purpose of this process is to achieve surface-hardness without affecting core properties. Jets of flame are played directly on the steel, and hardness penetration can be made to vary considerably. In alloy steels this depth will range usually from 0.03 to 0.12 in., the actual figure depending upon the method of heating and quenching used.

Unlike carburizing, flame-hardening does not involve the absorption of extraneous elements by the steel. There is no alteration of the chemical composition. To put it simply, the steel must have its own self-hardening characteristics; it cannot be dependent upon carbonaceous salt baths, gases, and other media.

Flame-hardening is not a substitute for the conventional furnace method. Each has its uses. The particular virtue of flame-hardening is that the flames can be directed to localized areas. The furnace, on the other hand, is generally more economical and feasible when parts produced in large quantities must be hardened all over.

Any type of hardenable steel, alloy, or carbon, can be flame-hand-

ered, and there will usually be no scale or pitting. The alloy content is the governing factor when determining the quench. In some cases a rapid quench is required, in others it can be as slow as air-cooling. Tempering presents no problems, for flame-hardened steel can be tempered as if hardened to the same degree by other methods.

A list of typical flame-hardened parts includes such familiar items as gear and sprocket teeth, and certain types of cams and rollers, and shoe threads. A complete list would include many other parts that often require a localized hardening treatment, especially for wear resistance.

When you need information about flame-hardening methods, please feel free to consult with our technical staff. Bethlehem metallurgists will work with you, at no obligation, and you can depend on their suggestions. You can rely on Bethlehem, too, as a source of alloy steels.

for Bethlehem makes the complete range of AISI standard grades, as well as special-analysis steels, and all carbon grades.

This series of alloy steel advertisements is now available as a compact booklet "Quick Facts about Alloy Steels." If you would like a free copy, please address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

after the most landing gear wheels struck a snow bank along the side. A portion of the lower tip of the rib at station 33, which remained attached to one piece of lower cover, is thick built at the rib 3-3 and 3-4.

apices, had all teeth skewed in a random pattern at five of the six 'IP' sites between the above-mentioned points. On the piece of rib cap there were obvious due to rubbing of separated diagonals against the top end of one rib rib on the same 'IP' site.

In this area of the song most attributes of the eyes to darkness and in the song many failed. Both the random pattern of the failure and the absence of making pairs or indicators of disease conditions with high and changing scores in the song occur during and after the six children. The random pattern of six and six attachment failure of the No. 3 task was a further indication of the known failure produced by the measurement of six. The first and

Study of the damage to the left reinforced concrete support structure and aerials disclosed that the lower right longitudinal stringer of the firewall failed in a clean tension break. After this the front end of the engine support moved upward and to the left with progressive damage and separation from the aft fuselage structure. Laboratory examination of the Load mounts which support the propeller reduction gear box disclosed evidence of repeated loosening due to abnormal loading in various directions.

Nonlinear correlations sometimes appear as partly parallel ridges on the outer surface of the sand throughout extension and as wavy scratched areas on the inner surface of the hot pipe hull mainly indicate repeated indentations due to large cyclic motions of the engine cylinder in the same phase to

from over-displacement of the engine support structure from its normal position. Initial failure of the right aftward engine support structure consisted of a tension separation of the upper bolt lugs from the aft attach fitting at the firewall. The front end of the engine support then moved downward and to the right and caused a crack in the propeller with progression of damage. Initial separation from the wing occurred in the aft engine attachment. The right bolt lug separated from the aft attach fitting with resultant interference between the lug and fitting. The Lord mounts which support the propeller collection gear have also been damaged due to abnormal loading in various directions.

LABORATORY TESTS

Numerous fractured fittings and parts of the left and right outboard engine support and nozzle structures were attached to bilgeventy examinations. These examinations have disclosed no evidence of fatigue cracking, manufacturing material misprocessing of parts, or assembly attachments. All efforts will be directed to positive evidence identifying any of the noted damage, to the outboard engine support and nozzle structures as having existed prior to the last hull.

All recovered wreckage was examined for evidence of fire having caused the downing in flight. Only one probable area of fire prior to the right wing separation was found. This was in the aft part of the right engine nacelle, and the portion of the flap

to support with the ground. It provided no indication of the structure in the area - how the slight separation of the right wing and outboard engine support structure occurred.

The accident was characterized by separation in the area of portions of Nos. 1 and 4 propellers as well as the right wing. Major propeller components were found along the wreckage path in the following order:

- No. 3 propeller and stage portion of the induction gear assembly.
- No. 4 power section.
- No. 1 propeller in its relation with the right wing.
- No. 1 power section, inoperative and a portion of the induction gear assembly.
- No. 2 powerplant in case of the fuselage site.

All responses lay at the location at which they first contacted the ground except for a minor displacement downhole of the No. 1 test system.

There was no live damage to any of the powerplants. The blades of all propellers, except those of No. 1, were found in their exact position as in the immediate vicinity of their respective hubs. The No. 2 propeller, along with the remainder of the powerplant, was dug from the wreckage rather late and only sketched, portions of all blades were recovered.

CONTROL SYSTEMS

Powerplant control systems were damaged by squabbling and impact so that there is little or no reliable information with regard to power configuration at any time prior to impact.

- Delinquency for significant contamination
- Frequent reduction goals and severity data, sources for gun and/or housing factors
- Implementation for individual institutions
- Frequent status rates for overrepresentation, housing status, or other factors
- Policy compliance for typical operational activities
- Find groups and individual results for significant contamination or evidence of outcomes, time in facility
- Frequent policy change mechanisms for significant contamination or evidence of outcomes in facility
- Frequent and regular for outcomes, at

The vegetation was negatively correlated to elevation and positively correlated to soil moisture and soil nutrient factors. Examination of the No. 1 and 4 power plants showed that the stream channel with the poorest section of both rivers. The long-termers examined with the No. 1 energy power series and with the No. 4 power series, respectively, were the same. Significant differences in the No. 1 energy group showed that the vegetation type was, approximately, the diaphanous *giant knot*. Good factors that occurred at separation river, called down and best as a pollution showing content. Significant variation of the forward part of the vegetation was observed. The separation function of No. 1 and 4 power plants was not obvious at large or good separation marks, which indicated local level growth.

Ideas you can use from

B.F. Goodrich



ZIPPED JET SEAL. EFG upper chamber permits easy access to enclosed equipment such as heat exchangers. Seals effectively against liquids, gases, dusts, dirt, corrosion. EFG upper can be custom-blended for your product, or supplied in part of a complete closure.



FLEXIBLE FUEL-LINE DOWNSTREAM Special flexible rubber joints reinforced with steel bands ideal for aircraft fuel line systems. These connectors have no expansion and are used in areas where leaks and deflection are severe. Withstand bending and various abuse levels.



NEW PACKAGE. EFC tube cases include shapers with integral electric heating elements for crimping on to components on localized areas such as jet intakes, nozzles, propeller blades, pumps. Fabricated to fit perfectly in complex curves or odd shapes.

For more information check your
R.F. Goodrich Aviation Products Representative,
or write *Aviation Products*, a division
of The R.F. Goodrich Company, Dept. AF 7A,
Akron, Ohio.

BETHLEHEM STEEL COMPANY BETHLEHEM, PA. 1-800-391-5463, Bethlehem Steel Corp. 12001 Carnegie Ave., Bethlehem, PA 18018



BETHLEHEM STEEL

at Sikorsky Aircraft ...

There are rewarding growth opportunities for qualified

STRESS ENGINEERS

V/SOL DESIGNERS

**AERODYNAMIC
RESEARCH ENGINEERS**

**WEIGHT CONTROL
ENGINEERS**

... experience is airborne work

Sikorsky Aircraft is making rapid advances in a variety of stimulating long-range programs. New military and commercial capabilities and requirements offer unusual opportunities to further professional status and build for a solid future with personal growth. We offer qualified men important roles in this stimulating and ever growing field of technology.

In general, graduate engineers are preferred in these categories.

Please submit your resume, including minimum salary requirements, to Mr. Leo J. Stodary, Personnel Department

SIKORSKY AIRCRAFT
DIVISION OF UNITED AIRCRAFT CORPORATION

STRATFORD
CONNECTICUT

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

No Short TOP ENGINEERS

We need a major specialist in top communication equipment. Best class man for a first class job. Offering top pay and liberal benefits (open to all locations). Lockport Electric has immediate openings for qualified men in:

- Control Design
- Instrumentation
- Standards
- Quality Assurance
- Component Development

Requirements: BSEE degree and one year's CECEC experience. Send resume or call collect to:

Lockport Electric, Inc., 1000 E. 1st St., Lockport, IL 60459. Or, 312/251-1100. No Fr.

LOCKPORT ELECTRIC
Equal Opportunity Employer



Effective Engineer Recruitment Advertising Depends on Engineering Readership

Aviation Week
and **Space Technology**

CLASSIFIED ADVERTISING: AVIATION WEEK
P.O. BOX 12, NEW YORK 26, N.Y.

PERSONNEL MANAGERS

Looking For
Experienced Engineers...
Technical Personnel?

Write for a free copy at:

"HOW TO ATTRACT ENGINEERS"

This 8-page booklet is designed for personnel people faced with the problem of recruiting engineers and technical people.

The top-flight engineers and technical personnel you want are at a premium. At this twenty-page booklet points out how you can reach and influence these men in the story told.

This booklet describes the McGraw-Hill publications best suited to reach the specific type of engineer you want.

Now you can make contact directly and coordinate your employer's advertising to put the man with the job qualifications you want. Helpful hints to consider and pitfalls to avoid when you prepare your copy and layout for an "Employment Opportunity" advertisement.

Write for your free copy to ...

F. A. Johnson
Qualified Advertising Service
McGraw-Hill Publishing Co., Inc.
P.O. Box 12, New York 26, New York

DESIGN ENGINEERS



Inquire about new opportunities for highly qualified engineers in the fields of avionics, controls, electrical and electronics, engine/motor, equipment, fuelage, hydraulics, landing gear, power plant and wing design.

Requires

AE, ME, EE or related degree with aircraft or missiles experience preferred.

Combine work in an exciting professional environment with living in one of the finest cities in the country.

Write: Hugh L. Gaudin, Professional Employment

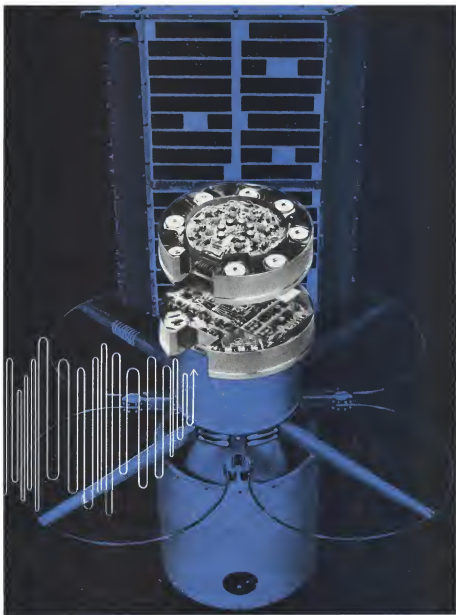
Manager
Lockheed Aircraft Corporation
838 West Peachtree St.
Atlanta 9, Georgia

LOCKHEED/GEORGIA

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

WANTED an outstanding writer

We are a major aerospace company in the Los Angeles area with important programs in every category of defense effort. We need a professional writer of demonstrated ability who can produce sophisticated speech material, prepare management communication documents, backstop engineers in drafting articles for technical publications, and fill an information pipeline for magazines and writers interested in reporting on our company's manifold activities. This position provides an exceptional climate both physically and intellectually for creative endeavor. Salary is dependent on your experience and achievement. Write Norman Warren, P.O. Box 1525, Beverly Hills, California.



UNUSUAL CAREER OPPORTUNITIES FOR QUALIFIED SCIENTISTS AND ENGINEERS...REGARDLESS OF RACE, CREED, COLOR OR NATIONAL ORIGIN...WRITE AVCO TODAY.

Telling a satellite what to do next. Now in orbit aboard Explorer XI is a uniquely selective receiver. It accepts instructions from NASA transmitters—ignoring stray signals, noise and interference—and relays them to a decoder which instantly actuates the satellite's controls. This receiver-decoder unit, weighing only 3.5 pounds, was designed and built by Avco's Electronics and Ordnance Division.

Avco

AVCO CORPORATION, 750 THIRD AVENUE, NEW YORK 17, NEW YORK